METAL INDUSTRY

ELECTRO-PLATERS-REVIEW
BRASS FOUNDER AND FINISHER
COPPER AND BRASS
ALUMINUM WORLD

VOL. 34 NEW YORK, DECEMBER, 1936 No. 11

# Practical Time Study Methods in Metal Products Manufacturing

**Simple Methods Used in Modern Small Plants to Determine Production Per Hour for Establishing Piece Work Rates, etc.**

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"STANDARD" is a much used word, but in this case it means "a reasonable quantity," produced by a medium skilled operator, a fair allowance for "time out," with normal working conditions, right machine speed, tools, etc.

This will be based on the "over-all" time and not a complicated, elaborate "break-down" of all the elements or motions that go to make up the complete process.

Whether the production per hour is needed for wage payment, estimate production control, schedule of production, promised delivery date, etc., it should be as nearly correct as is possible to determine, without a highly scientific time and motion study.

All that is needed to start and maintain:

1. Right man to do the time study.
2. A stop watch.
3. Printed form on a 3" x 5" card.
4. A small filing cabinet.

The qualifications of time study man are at least 5 years' practical experience in your line—preferably in your plant. He must know exactly what he is to do and how he is going to do it. He must be mechanical, analytical, tactful, forceful, fair, painstaking and above all be greatly interested in what he is doing.

Use a good standard make of stop watch. For "over-all" timing there are also good special watches called "extended," which save considerable time by eliminating calculations or the use of the slide rule to get the quantity per hour.

The card form, size 3" x 5", printed both sides contains all the data; the headings are self-explanatory, the information is valuable and should be retained for quick reference. (See Figs. 2 and 3 on page 466).

The cabinet, a single draw cardboard file will answer nicely. It should be indexed. Classify the major operations, such as blanking, bending, drilling, grinding, etc.

### The Use of the Stop Watch

If using the "Extended" watch, push starting lever to the right and start counting the number of pieces being made. After ten pieces have been produced, push the lever to the left and if the small hand is on the red division, use the figures printed in red on the extreme outer row. Assume it was stopped on the 30 second line; the quantity per hour is shown as 1200.

For operations that are quick, count 100 pieces and add a cipher. For those that are much slower you can use one piece and then disregard the last digit; if timing more than 1 piece multiply by the number and disregard the last digit. The results equal the quantity per hour.

If you prefer you can use the standard time study watch, ascertain the number of seconds required to do one or more and then figure the seconds required for one and divide into 3600 (seconds in an hour) and the answer is the hourly production. You can, of course, use the regular pocket or wrist watch but the second dial is so small it is difficult to read accurately.

### Time Study and Piece Work Card

At the operator's place of work have the card and stop watch stand; or better still, be seated 3 to 4 ft.

from the operator. First explain to the employee that you are about to time the process and you want to get it right. Therefore, the operator should try to give you his best, but not at a "rapid fire" pace

Fig. 1. Extended Time Study Stop Watch

that he can't maintain nor should he go at a slow speed—just his normal rate.

After you have made enough different timings to be able to select one you know is right, move to another operator and assume you are timing him, but in reality time so as to check the one you are timing. Many experts don't believe in doing this, but it is a quick check and works generally so, that you get lower production per hour. If not you have an automatic warning to proceed with extreme care.

Enter your results under heading "pieces per hour," on reverse side of card. Don't average the results unless you have to. In some cases, however, you must average to get the correct "gross standard" especially if reaching for work, etc. takes some time and occurs after every fifth or sixth timing.

Best results are derived by making a selection. Generally the amount shown the largest number of

| | | | |
|---|---|---|---|
| PART No. & NAME | 1013 Brass Cord | $ .70 RATE PER M | |
| OPER. | Assembly | SEQ. 8 | DIE No. — |
| STANDARD PER HR. 500 PIECES | BASED ON .35 PER HOUR | EQUIPMENT Hand Work | |
| DATE EFFECTIVE 7-28-36 | DEPT. 45 | APPROVED Chas. W. Kaufley | |

| PREVIOUS RATES | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE | NEW | | | | | | |
| PIECES PER HR. | | | | | | | |
| RATE PER HR. | | | | | | | |
| RATE PER M | | | | | | | |

Fig. 2. One Side of Time Study Card. Part Identification.

times (or amounts in close proximity) is most nearly correct. See entries on card. Note that amount 461 is entered four times out of nine different "hours." Therefore, select 461. In timing operator No. 116, the figures 391 appear three times out of six timings; select 391. (Entered under Standard Gross).

### Rating of Operator

Right here is the important factor and in order to do the job right, it requires good sound judgment. The right rating in "over-all" time study work is not impossible to master. It can be accomplished in a short time if the will to do so is strong enough. The range in the efficiency of various employees will be from 25-125%. Such a range, all will agree, makes it a mean variable to cope with.

It is evident that a group of workers being paid on time work really have very little incentive to turn out a fair day's work and generally are about entitled to a 50% mark in rating. However, some may be 100% in the effort.

As a general rule with experienced, loyal employees a rating of 65 to 85% will apply. The best advice to the beginner is "not to rate too high." There are many reasons why!

### Some of the Major Facts to Consider in Rating

1. Is operator "stalling" (purposely working more slowly than usual)?
2. Is operator new (not experienced)?
3. Is operator slow, medium or fast?
4. Is work easy to reach?
5. Is work disposed of quickly?

TIME STUDY

| DATE | EMPLOYEE | PIECES PER HOUR | | | RATING % | STANDARD GROSS | STANDARD NET |
|---|---|---|---|---|---|---|---|
| '36 | #101 | 439 | 461 | 446 | | | 553 |
| | | 461 | 473 | 461 | | 461 | 55 |
| 7-28 | Agnes Spinno | 515 | 439 | 461 | 80 | 92 | 498 |
| | #116 | 400 | 391 | 391 | | | 547 |
| | | 446 | 391 | 367 | | 391 | 55 |
| 7-28 | Lillian Cooney | | | | 60 | 156 | 492 |
| | | | | | | | |

#116 is a very slow operator

PIECE WORK RATE CARD

FORM NO. 100 2M 11-34 S

Fig. 3. Other Side of Time Study Card. Record of Time Study.

6. Does operator lose time getting work?
7. Lost time on account of waiting for work.
8. Lost time, awaiting orders from foreman.

We have rated Employee No. 101 at 80%. Therefore, we must add 20% to our gross figure of 461 pieces per hour, and then we allow 10% for rest, personal necessities, etc., and arrive at a net of 498. Note that Employee No. 116 was rated at 60%, and the net was 492. Therefore, we set 500 pieces per hour as the standard.

### Allowed Time for Rest, Talking, Inspection, Necessities

This can be ascertained fairly accurately. Different occupations may vary. Use judgment in determining the percentage to allow. The range is generally from 10-25% depending upon conditions, type of operation, layout, flow of production, supervision, etc. Many have agreed that 10% is a fair allowance. This doesn't appear too low. Using an eight hour day it means we are allowing eight-tenths of an hour or 48 minutes.

If you care to establish a standard allowance for different occupations, it can be done by keeping a record for a few weeks of the "time out" factor for the specific occupation and calculating the percentage to the total.

### Base Hourly Rate to Use for Piece Work

Ascertain the average hourly rates now being paid the various employees in the different occupations. Then decide how much more you want them to earn when being paid on a piece work basis. The differential is 10 to 33 1/3%. Compile a schedule showing the various occupations with the rate per hour the employee should earn when paid piece work. For example:

| OCCUPATION | RATE |
|---|---|
| Assembling—Hand | $.35 |
| Assembling—Power | .45 |
| Buffing | .85 |
| Drilling | .45 |
| Grinding | .80 |
| Soldering soft | .60 |
| Soldering hard | .80 |

### Calculation of Rate Per Unit of Production

We set the standard per hour (see Fig. 2) as 500 and established a base hourly rate for assembling by hand of 35c. Therefore, 35c ÷ 500 = $.0007 per piece and our unit of quantity is to be 1,000 pieces so that the rate is $.70 per 1,000 pieces.

To save time a table can be compiled and used to advantage.

| STANDARD PCS./HR. | BASE HOURLY RATE .35 | .40 | .45 | .60 |
|---|---|---|---|---|
| 300 | 1.20 | 1.35 | 1.50 | 2.00 |
| 325 | 1.10 | 1.25 | 1.40 | 1.80 |
| 350 | 1.00 | 1.15 | 1.30 | 1.70 |
| 400 | .90 | 1.00 | 1.10 | 1.50 |
| 450 | .80 | .90 | 1.00 | 1.35 |
| 500 | .70 | .80 | .90 | 1.20 |
| 550 | .65 | .75 | .85 | 1.10 |
| 600 | .60 | .70 | .75 | 1.00 |
| 650 | .55 | .60 | .70 | .95 |
| 700 | .50 | .55 | .65 | .85 |

### Starting Application of Piece Work

If you decide to use the wage payment plan of piece work, it is advisable to start with those jobs you don't get often and make these few rates high on purpose. This is to give a few employees a taste of the incentive in their pay envelopes so as to get the others to ask for it, not "buck" it.

Don't have or tolerate limits of earnings. Don't cut or reduce a rate once it is established unless a decided change has been made in conditions, tools, equipment, etc., and then only if it is thoroughly understood by the operatives. Explain in detail, show the change, and moreover, unless the change warrants a substantial saving, do not change the rate. This is the reason why so many claim that piece work is "old fashioned," and therefore, they must have a complicated system which is confusing to both employers and employees.

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# Down-Draft Furnace Melting

Q.—What is the right way to operate a down-draft open flame furnace?

A.—1. Furnace should be so constructed as to assure a steady pressure of oil and air. The most essential point is the oil pipe that fits in the tuyere. It should be held in the center of the tuyere. Use an oil pressure of 35 to 40 pounds, and 20 to 22 ozs. of air. As noted previously, the pressure must be steady and positive.

2. The furnace should be kept clean, allowing no slag or metal hanging on the side or bottom of the furnace. If the furnace is making slag the combustion is not taking place properly. Another point is to keep the shape of the furnace in good repair. It should be pear-shaped. Assuming your furnace is in good shape and that a nice glaze has been formed over the lining of the furnace, you are now ready to operate.

3. Run the furnace 10 minutes to heat thoroughly. For a 600-lb. charge of red brass, charge 1 lb. of 15% phosphor copper; then charge your metal. Start your furnace. See that there is no obstruction in front of the tuyere and that sufficient room is left for the combustion to take place. The tuyere opening should be held at about 1¼" and repairs made every day around the tuyere.

The door of the furnace is closed. The furnace is started off with a sky-blue color, turning to rainbow color and gradually turning to a yellow-white, then to a strong white with a tint of green—at which time the metal is ready to receive the mix if any is required, such as tin, lead or zinc—which should be done as quickly as possible, and poled for a half-minute with a hickory pole. If zinc is added, it is best done with a pair of tongs and stirred. For most work, further heating is unnecessary. However, pyrometers should be used to check the heat of the metal before pouring.

4. A ladle lined with clay, which has previously been heated good and hot, is very essential point. Otherwise the metal is very likely to boil—and in that case the metal should not be poured into casting as it will be found porous when turned up.

5. We suggest as a cleaner and purifier the use of flux composed of:

60% coke dust ground fine
20% lime
10% silica sand or fluorspar
10% common rock salt

Use 5 to 10% of this mixture in the furnace and you will find cleaner, solider castings when this flux is used. It also keeps the furnace clean. Add 2% when charging the furnace, balance when metal is melted, which is in about 15 minutes. We have found it protects the metal with a covering at the same time decomposing oxides that may be taken up in the melting before the covering can cover the metal.

Users of this style of furnace who have followed these instructions have obtained excellent results.

—W. J. Reardon.

# The Melting of Platinum

**Melting Small Lots; Filings; Defective Metal; Difficulties; Large Melts; Platinum Sponge; Platinum Alloys; The Electric Furnace; The Oxygen Torch; Other Accessories; Crucibles and Refractories. Conclusion***

By C. M. HOKE
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### Large Melts

When large melts—40 ounces or more, perhaps—are made, lime crucibles are preferred. These will be described later in detail. Lime holds the heat excellently, nor does its surface soften to permit the metal to sink into it. Sometimes two torches are used at once. Usually the metal is fed in a little at a time from ladles previously filled and set close at hand.

With large melts it is impossible adequately to stir the metal with the force or "blow" of the flame; some other method of mixing must be devised. Sometimes a small carbon rod is used; sometimes the crucible is set into a support shaped like a casserole with a long handle and semi-spherical base; as the metal melts the worker tips and tilts this support on its rounded base, effecting proper mixing.

When small amounts of metal are melted, the button cools so quickly that it is practically impossible to pour it into a mold. Larger melts, when properly handled, retain enough heat to permit pouring if desired, and usually they are cast into bars or blocks, the forms being made of hard carbon or graphite, sometimes lined inside with thin platinum foil.

### Platinum Sponge

This is the form in which platinum is obtained after refining. Clean sponge is a pleasure to melt, being handled essentially the same as clean clippings. When preparing sponge, the refiner does well to heat it slowly but strongly to about 1000 degrees C., which causes it to shrink into a firm clinker-like form, easy to melt and not inclined to blow away from the flame.

### Platinum Alloys

The commonest of platinum alloys, the iridio-platinum alloys used in jewelry and other fields, are usually made by taking platinum sponge and iridium sponge in proper proportions, mixing well, and then melting. The combination has a higher melting point than that of pure platinum, but the technique is not different. The methods previously described in this paper all apply equally well to pure platinum and to the iridio-platinum alloys that are in general use.

Within the last few years a great many other platinum alloys have been developed, of which the most interesting are the gold-platinum alloys used in dentistry. These are sometimes quite complex, containing gold as the major constituent, with silver, copper, platinum, palladium perhaps, and sometimes other metals, in varying proportion. The number of formulas now in use is quite large. When the proportion of platinum is low, these are prepared in the gold-melting furnace, the low-melting ingredients being melted together first, and platinum, usually in small pieces, being added toward the last. Or, gold and platinum may be melted together with the oxy-gas flame, the same as platinum alone, and this alloy is then melted in a gold-melting furnace with the other ingredients.

However, as the requirements of the dental profession have become more and more exacting, and as research on these alloys has opened up new fields for their use, greater care and uniformity have been demanded in their manufacture. The electric furnace of the high frequency induction type has proven very satisfactory for this work, for reasons which will be mentioned shortly.

### The Electric Furnace

Ever since the Ajax-Northrup induction furnace was first developed, in about 1916, its application to the precious metal field was inevitable. Its cleanliness, convenience, freedom from fumes, and the startingly high temperatures it produced, have lead many workers to experiment with it. Its first application in this field was in the melting of silver, where it has been notably successful, and it is now being used also in melting gold and the ordinary gold alloys, as well as the special dental alloys mentioned above. It has been extremely useful in basic research on platinum and the platinum alloys.

The outfit consists of two main parts, the converter which changes currents of commercial frequency into the high-frequency current, and the furnace proper. This latter is essentially a metal coil through which the high frequency current oscillates. When a crucible containing metal, such as platinum, is placed inside this coil, the electric eddy currents induced in the platinum quickly raise its temperature to the melting point or beyond. Theoretically there is no limit to which this temperature can be raised; the practical limits are determined by the refractory that contains the melt, and the wishes of the operator.

As the illustration shows, the furnace proper, or coil, may be small enough to be lifted bodily for pouring. The cleanliness and convenience are obvious. Another convenience of the induction furnace is that it automatically stirs the melt—the eddy currents within it cause active turbulance in all parts of the metal. This is especially desirable in making up the complex dental alloys with their many constituents. It

 In September and November 1936 METAL INDUSTRY published an article with this same title by the same author. The present article brings the subject up to date.
Part 1 of the present article was published in our November issue.

is calculated that one plant alone has already melted up more than $10,000,000 worth of gold and platinum-gold alloys in a furnace of this type.

A final advantage of the induction furnace is that the atmosphere surrounding the melt can be controlled perfectly. Air can be admitted or excluded; hydrogen, nitrogen, or other gas can be substituted; or the whole operation can be carried on in a vacuum. These possibilities have been exploited by the research metallurgist as well as by the conscientious manufacturer.

Up to the present, however, the electric furnace has not supplanted the oxygen torch for the routine melting of the simple platinum and iridio-platinum alloys, either in large or small lots. This is due mainly to the great difference in costs, the converter especially representing a sizeable investment, while the oxygen outfit is within the means of even the humblest jewelry shop.

### The Oxygen Torch

Dr. Robert Hare of Philadelphia, the inventor of the oxy-hydrogen blow pipe, was the first to melt platinum in the modern manner; that was in about 1847. In 1859 the French chemists Deville and Debray designed an improved furnace for the purpose, consisting of a blowpipe and lime crucible. Innumerable improvements in details have been made since then, but the same principles are being used to-day.

The simplest oxy-hydrogen or oxy-gas blowpipe consists of little more than two pipes and perhaps two stop-cocks. The early ones, which used both gases under fairly high pressure—up to 220 lb. per square inch—were apt to back-fire and burn inside the tubing, with resulting damage to the blowpipe and possible danger to the operator. With the advent of platinum as a fashionable jewelry metal, in the first and second decades of this century, many improvements of torch design appeared, attention being given both to safety and efficiency. The rapid growth of the compressed oxygen industry was a big factor in the vogue of platinum. Indeed, without cheap and available oxygen, platinum would still be a laboratory curiosity.

By 1912 or so, it was a common sight in the larger jewelry shops to see the two large cylinders, one with low-pressure (200 lb.) oxygen, the other sometimes containing hydrogen, but much more often simple city gas compressed to the same 200 pound pressure. But early in the World War days, Sam W. Hoke conceived the idea of a torch that would use city gas at ordinary house pressures — less than a pound — in conjunction with the inexpensive high-pressure oxygen. This was a much more convenient and economical arrangement. A patent was granted in time, and many of the early models are still in use. The patent involved a mixing device close to the nozzle of the torch, by which the gas in the outer tube was slightly rotated, through rifling of the barrel, and the oxygen in the inner tube was broken up into many small streams, with the result that the two were mixed in the proper proportion, in spite of the difference in pressures behind them. The small cut shows the mouth of the torch; oxygen comes through the many small holes

**Fig. 4. Mouth of modern oxy-gas torch, showing many small apertures for oxygen, four large passageways for gas**

in the central cap; gas through the four large outer passageways. Other successful models utilized the old injector or Venturi principle to attain the same end—proper mixing of oxygen and fuel gas. By means of minor adjustments the torches were adapted to natural gas or to hydrogen, as well as to city gas.

One big problem was the material for the nozzle. The heat of the flame is sufficient to melt most metals promptly, especially if the torch be held in such a way as to let the flame play back upon it. Other metals, such as some high temperature steels, do not melt promptly, but form copious scale which soon drops off into the molten platinum. This last, as any platinum worker knows, may be a real calamity. The ideal material for a nozzle is of course platinum itself, and some of the large plants and Mints are indeed using platinum nozzles. For the ordinary shop, however, this luxury is out of the question, and other materials had to be found, of which the best so far are certain nickel alloys; these do not melt if the flame is held at the proper angle, and such scale as does form is closely adherent.

### The Oxygen Regulator

This is an important part of the outfit. The pressure within a full cylinder of commercial oxygen is about 2,000 pounds per square inch. Platinum melting requires a pressure of from 2 to 20 pounds, more or less, depending upon the quantity of metal, whether it is in the form of filings or scrap, etc.; also on the size and type of torch Therefore a reducing valve or pressure regulator is essential. The one shown has three parts—a large gauge that shows the pressure within the tank at all times; the reducing valve proper (also called a diaphragm valve) with a set-screw for adjustment; and a small gauge that indicates the pressure at which oxygen is being delivered. This part of the equipment also has received much study during recent years, and many improvements have been made. These lead primarily to safety. At the same time they have increased the economy and ease of operation, by making the oxygen delivery more delicately adjustable. It is now easy to get a flame of any size—a mere pencil for making a test melt of a few filings, or a full size flame of highest intensity —and to maintain it without fluctuation or slackening for long periods.

### Spectacles

The light emitted by molten platinum is such that dark lenses are essential. Lightly smoked or tinted glass is quite inadequate; lenses almost as dark as those used by the oxy-acetylene welder are preferred. Most workers find cobalt blue the easiest on the eyes. The frames or temples should be designed for quick doffing and donning; complicated straps or buckles are not convenient.

### Tongs

The tongs illustrated were designed especially for platinum work. The bowed part fits around a

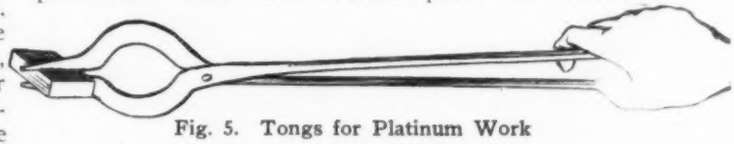

**Fig. 5. Tongs for Platinum Work**

crucible; the slim flat pointed ends will lift a button out of a crucible and will hold the button on the anvil while it is being hammered.

### Crucibles and Refractories

Lime was the first choice for a crucible material; fresh high-burned lime. It was troublesome—it

quickly absorbs moisture and becomes useless; since it is a natural product coming in irregular lumps, the purchaser often had to pick over many pieces before finding one of the right dimensions, free from cracks. A cup-like cavity was carved in a square block, and the block bound in sheet-iron or wire and

**Fig. 6. Ajax-Northrup High Frequency Induction Furnace. The converter is in the left background, the furnace proper in the foreground**

provided with a handle for tilting. A cover consisted of a second block, carved in an arch, with two holes, one for the torch nozzle, the other for the escape of the products of combustion. A crucible cannot be used often, nor can it be stored, and it seemed that the worker spent a great deal of his time carving lime. But even with these disadvantages, lime is still in general use, especially for large melts or where special purity is demanded. It holds heat amazingly well. It does not contaminate the melt. If bits of lime stick to the metal, they can be readily soaked off in hydrochloric acid. A big factor in its popularity is its cleansing effect on the melt, as it absorbs minor impurities after the manner of a cupel.

To-day, in plants that habitually make large melts, instead of carving the natural blocks, they crush and granulate dry lime and press it into blocks with a hydraulic press, using pressures up to 150 tons to the square inch. These blocks are then carved into crucible and cover, and bound in sheet-iron, in the same manner as before. For a melt of 400 ounces—8000 pennyweight—a lime block 9 inches across and 5 inches high, outside dimensions, properly carved, is adequate. Just before use the crucible should be heated slowly to drive out any moisture or gases.

Zirconium oxide and zirconium silicate, highly refractory materials, have been shaped into crucibles for this work, especially by some of the larger refineries and Mints. They resist heat remarkably well, and a crucible can be used scores of times, day after day. They have not the cupelling effect of lime, but in most other respects are excellent crucibles. Probably the one factor that stands in the way of their general acceptance is their cost; much cheaper materials, though admittedly inferior in one respect or another, serve the purpose well enough.

When platinum first came into use in jewelry, most melts were made in the familiar Hessian type sand or clay gold-melting crucible, with one side broken down. Even to-day crucibles of this class that get broken in transit are used for this purpose. Shortly, however, J. Goebel provided platinum-melting models of a similar composition, but shaped as illustrated, with the high side and a flat bottom. The flat bottom is important, especially when filings are to be melted, because it permits the flame to reach and burn out impurities. One big fault with the broken-down gold-melting crucible is the fact that it tapers sharply at the bottom.

Some workers have reported that the sand or clay crucible is apt to contaminate the melt with silicon or iron. However, for ordinary shop and routine work, this contamination, if it occurs, is too slight to affect the metal's usefulness. It should be recalled that an oxidizing flame should always be used; a reducing flame—one of a yellow color—can reduce sand to silicon or lime to metallic calcium, both of which elements are taken up by the molten platinum to its detriment. No doubt some crucibles have been blamed for contaminations which in fact were caused by the wrong flame.

Graphite or carbon is not suitable for platinum work. Platinum absorbs carbon with the formation of a brittle carbide. It is true that sometimes carbon stirring rods and ingot molds of graphite are used, but these are not in contact with molten metal for any length of time.

Quartz or silica crucibles have been suggested for platinum, also aluminum oxide (Alundum). These substances, however, melt at so nearly the melting point of platinum that they are unsuitable. It is true that the "sand" or clay crucibles also melt under the flame, but so slowly that normally the melting job is finished before the glazing does any harm.

Some workers, especially when handling very small quantities, use common scorifiers for this work. This practice is not advised because the material was intended for use at much lower temperatures, and softens unpleasantly under the oxygen flame. The

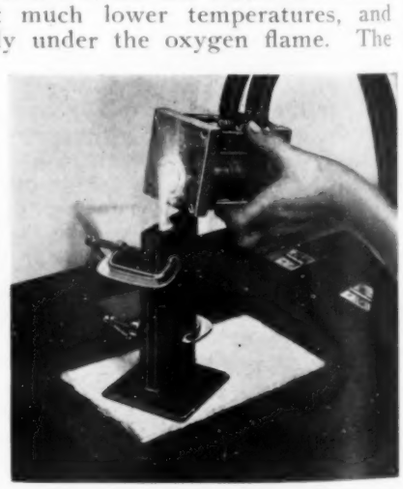

**Fig. 7. A Very Small Ajax - Northrup Furnace. A type used in research work on the platinum metals, dental alloys, etc.**

shape of the scorifier is not objectionable—only its composition. The shape is excellent, and has been chosen, with slight modification, for the manufacture of some very good crucibles of a composition that is suitable for platinum work. The worker should keep this distinction in mind.

# Recommended Practices for Sand Cast Magnesium Alloys

**A Report of Nonferrous Division Committee on Recommended Practices of the American Foundrymen's Association. Conclusion***

## B. PROPERTIES AND APPLICATIONS

### 1. Chemical Control Limits

The strength characteristics of these alloys are determined primarily by their aluminum content. Small percentages of zinc are added to improve the corrosion resistance and certain physical properties, but the amount of zinc must be kept relatively low to avoid hot-shortness, particularly during heat treatment. The best combinations of properties are obtained with alloys containing 8 to 12 per cent of aluminum or of aluminum plus zinc. Alloys with less than 80 per cent of added metal have relatively poor casting characteristics and low yield strength and hardness, while alloys with more than 12 per cent of added metal are too brittle for most purposes.

Manganese should be present in all magnesium casting alloys in amounts ranging from 0.1 to 0.4 per cent, that is, in amounts approximating the solubility of manganese in the liquid alloy. These percentages of manganese have little to no effect on the physical properties of the alloys but very materially improve their corrosion resistance, particularly towards salt water.

Since copper and nickel have a very deleterious effect on the corrosion resistance, all metal handling operations, particularly remelting, must be carefully controlled so as to prevent contamination. Alloy C-15, however, purposely contains a large percentage of copper to yield a material with high thermal conductivity, but this advantage is gained at the sacrifice of corrosion resistance. Small amounts of silicon exert no appreciable effect on the corrosion resistance but as the percentage is increased, the alloys become more brittle.

TABLE 1. MAGNESIUM ALLOY INGOT FOR REMELTING

| Alloy | Magnesium Per Cent | Aluminum Per Cent | Manganese Min. Per Cent | Zinc Per Cent | Copper Per Cent | Cadmium Per Cent | Silicon Max. Per Cent | Other Impurities[1], Max. Per Cent |
|---|---|---|---|---|---|---|---|---|
| C-11 | Remainder | 8.0-9.0 | 0.18 | — | 0.04 max. | — | 0.2 | 0.3 |
| C-12 | Remainder | 9.4-10.6 | 0.13 | — | 0.04 max. | — | 0.2 | 0.3 |
| C-13 | Remainder | 11.5-12.5 | 0.13 | — | 0.04 max. | — | 0.2 | 0.3 |
| C-14 | Remainder | 5.5-6.5 | 0.18 | 2.7-3.3 | 0.04 max. | — | 0.2 | 0.3 |
| C-15 | Remainder | 1.7-2.3 | 0.20 | — | 3.3-4.7 | 1.7-2.3 | 0.2 | 0.3 |

[1] Nickel max. 0.02 per cent.

TABLE 2. MAGNESIUM ALLOY SAND CASTINGS

| Alloy | Magnesium Per Cent | Aluminum Per Cent | Manganese Min. Per Cent | Zinc Per Cent | Copper Per Cent | Cadmium Per Cent | Silicon Max. Per Cent | Other Impurities[1], Max. Per Cent |
|---|---|---|---|---|---|---|---|---|
| C-11 | Remainder | 7.8-9.2 | 0.15 | 0.3 max. | 0.05 max. | — | 0.5 | 0.3 |
| C-12 | Remainder | 9.0-11.0 | 0.10 | 0.3 max. | 0.05 max. | — | 0.5 | 0.3 |
| C-13 | Remainder | 11.2-12.8 | 0.10 | 0.3 max. | 0.05 max. | — | 0.5 | 0.3 |
| C-14 | Remainder | 5.3-6.7 | 0.15 | 2.5-3.5 | 0.05 max. | — | 0.5 | 0.3 |
| C-15 | Remainder | 1.5-2.5 | 0.15 | 0.3 max. | 3.0-5.0 | 1.5-2.5 | 0.5 | 0.3 |

[1] Nickel max. 0.03 per cent.

### 2. Physical Properties of Sand Castings

Physical properties of sand castings are given in Table 3 on page 472.

### 3. Conforming Specifications

Conforming specifications are given in Table 4 on page 472.

### 4. Development and Field of Use

Magnesium alloy castings are used chiefly in those industries where lightness is essential, that is, where a saving in weight results in a more economical operation of equipment or in a saving of human fatigue. This lightness, coupled with good mechanical properties, gives magnesium alloys strength-weight ratios

*Many phases of the magnesium foundry practice here described are covered by existing United States patents.

NOTE: This report was presented at a session on Non-Ferrous Castings at the 1936 Convention of A.F.A. in Detroit, Mich.

Part 1 was published in our November issue.

TABLE 3. PHYSICAL PROPERTIES OF MAGNESIUM ALLOY SAND CASTINGS

| Property | C-11 As Cast | C-11 H.T. | C-12 H.T. | C-12 H.T.A. | C-13 H.T.A. | C-14 As Cast | C-14 H.T. | C-14 H.T.A. | C-15 As Cast |
|---|---|---|---|---|---|---|---|---|---|
| Tensile Strength, lb. per sq. in. (Min. to Avg.)[1] | 23,000 to 26,000 | 29,000 to 34,000 | 29,000 to 32,000 | 29,000 to 34,000 | 27,000 to 29,000 | 24,000 to 27,000 | 30,000 to 35,000 | 32,000 to 39,000 | 21,000 to 24,000 |
| Yield Strength lb. per sq. in. (Perm. Set 0.2 per cent). | 11,000 | 11,000 | 12,000 | 19,000 | 21,000 | 11,000 | 11,000 | 19,000 | 8,000 |
| Modulus of Elasticity, lb. per sq. in. x $10^6$ | | | | | | | | | |
| Elongation, per cent in 2 inches (Min. to Avg.) | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 |
| Brinell Hardness, 10 mm Ball, 500 kg. load | 3-5 | 6-10 | 5-7 | 0-2 | 0-0.5 | 4-6 | 6-11 | 2-5 | 3-6 |
| Compression Strength, lb. per sq. in.[2] | 49 | 48 | 52 | 70 | 78 | 49 | 51 | 68 | 40 |
| Specific Gravity | 46,000 | 46,000 | 50,000 | 54,000 | 54,000 | 47,000 | 48,000 | 51,000 | 39,000 |
| Weight per cu. in.—lb. | 1.80 | 1.80 | 1.81 | 1.81 | 1.82 | 1.83 | 1.83 | 1.83 | 1.86 |
| Pattern Makers Shrinkage, in. per ft. | 0.065 | 0.065 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.067 |
| Solidification Range, °F. (Approx.) | 3/16 1120 to 815 | 3/16 1120 to 815 | 3/16 1100 to 815 | 3/16 1100 to 815 | 3/16 1070 to 815 | 3/16 1155 to 750 | 3/16 1155 to 750 | 3/16 1155 to 750 | 3/16 1185 to 1050 |
| Electrical Resistivity, (Microhms per $cm^3$ at 20°C (68°F) | 13.0 | 15.0 | 17.5 | 14.0 | 14.0 | 11.5 | 14.0 | 12.5 | 6.5 |
| Endurance Limit, lb. per sq. in. (R. R. Moore Machine, 500 mil. rev.) | 7000 | 7000 | 10,000 | 9000 | 9000 | 10,000 | 10,000 | 10,000 | 6000 |
| Coefficient of Thermal Expansion per °Fx$10^6$, (65-750°F) | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |

[1] Tension values determined on standard ½-in. diameter A.S.T.M. separately cast specimens.
[2] Results of tests on specimens having an l/r ratio of 5. All specimens failed by shearing.

TABLE 4. TRADE DESIGNATIONS OF CAST MAGNESIUM ALLOYS

| Alloy | Condition | A. S. T. M.[1] | American Magnesium Corporation | Bohn Aluminum and Brass Corporation (Bohnalite) | Dow Chemical Company (Dowmetal) | U. S. Army[2] | U. S. Navy[3] |
|---|---|---|---|---|---|---|---|
| C-11 | As Cast | Alloy 1 | AM 241 C | X-5 | A | — | 1 |
| | Solution Heat Treated | Alloy 1-H.T.1 | AM 241 T4 | X-5 H.T.. | A-H.T. | Grade 1 | 1a |
| C-12 | Solution Heat Treated | Alloy 2-H.T.1 | AM 240 T4 | X-2 H.T. | G-H.T. | — | 2 |
| | Solution Heat Treated and Aged | Alloy 2-H.T.3 | AM 240 T61 | X-2 H.T.A. | G-H.T.A. | Grade 2 | 2a |
| C-13 | Solution Heat Treated and Aged | Alloy 3-H.T.3 | AM 246 T6 | — | B-H.T.A. | — | — |
| C-14 | As Cast | Alloy 4 | AM 265 C | X-8 | H | — | 5 |
| | Solution Heat Treated | — | AM 265 T4 | X-8 H.T. | H-H.T. | — | — |
| | Solution Heat Treated and Aged | — | AM 265 T6 | X-8 H.T.A. | H-H.T.A. | — | — |
| C-15 | As Cast | Alloy 5 | — | X-4 | T | — | 3 |

[1] A.S.T.M. Spec. B80-34T (1934).
[2] U. S. Army Spec. 57-74-1B (1933).
[3] U. S. Navy Spec. M-112-c (1933).

decidedly superior to those of most other casting alloys. Magnesium alloy castings lose their strength at elevated temperatures, and therefore, are best fitted for use at or near room temperature.

Substantially all magnesium alloy castings are now produced from the Mg-Al-Mn or the Mg-Al-Mn-Zn alloys. They are amenable to property improvement by solution heat treatment followed by precipitation heat treatment or aging. Three specific compositions of the Mg-Al-Mn series are being used commercially, the choice of alloy and heat treatment being dependent upon the properties necessary to meet the particular service requirements. Alloy C-12, with its various heat treatments, gives combinations of properties satisfactory for many purposes and, hence, is the most widely used of the three. Alloy C-11 is used where a combination of high tensile strength, percentage elongation, and toughness is re-

quired. Alloy C-13 is used in the precipitated or aged condition where maximum yield strength and hardness are desired, even at the expense of toughness.

The Mg-Al-Mn-Zn alloys are a more recent development and are being widely used now that they can be successfully heat treated. Alloy C-14 is the most widely used member of this series and bids fair to replace the older Mg-Al-Mn alloys because it offers better combinations of mechanical properties with improved corrosion resistance. Some foundries are using it almost exclusively, while others are conducting extensive tests prior to its adoption. The as-cast properties are satisfactory for a large variety of uses while heat treated castings are used where service requirements demand maximum properties.

Alloy C-15 is a special composition with copper as the chief alloying ingredient. High thermal conductivity is its outstanding characteristic and it was developed primarily for use in pistons for internal combustion engines. The main functions of the other alloying ingredients is to improve its strength and foundry characteristics. The corrosion resistance of this alloy is much inferior to that of the other four magnesium casting compositions.

The aircraft industry is the largest consumer of magnesium alloy castings,—the more important applications including motor castings, starting equipment, instrument housings, landing wheels, and miscellaneous structural supports and brackets. The portable tool industry is using increasing amounts of sand castings for handles, motor cases, and gear housings in both electric and pneumatic drills, sanders, and the like. Magnesium castings are likewise used in the reciprocating and rapidly moving parts of textile, packaging, and conveying machinery or equipment as well as in fans, blowers, and rotors. Safety device equipment includes tongs, saw guards, and safety blocks for forming presses. Foundry uses include flasks, pattern plates, core boxes, and core setting jigs.

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# The pH of Electroplating Solutions

## A New, Simple Method of Determining the Acidity or Alkalinity of Various Electroplating Solutions

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### I. MEASURING THE PH-NUMBER OF ACID ELECTROLYTIC SOLUTIONS

**Acidity and How to Determine It.**

Any acid contains hydrogen which is electrically charged, and which is in the form known in chemistry as the hydrogen ion. The hydrogen ion ($H^+$) is the cause of the acid reaction in the same way as the hydroxyl ion ($OH^-$) is responsible for the alkaline (basic) properties.

The free acid content (which in the case of heavily diluted acids are almost identical with the hydrogen ion content) are in most cases determined by titration. This method is also applied by electro-platers, for instance, for the determination of the sulfuric acid contents of acid copper baths. Titration can be applied without any difficulty in all such cases where the acid contents of the solution under examination are not below a certain limit. Acid copper baths for example, contain 1 to 50 grams of sulfuric acid per litre.

With nickel solutions, however, titration is not practical because these baths, though they might have been acidified with sulfuric acid, also have a small boric acid content. With solutions of weak acids there is a great difference between acid content determined by the titration method and pH-value, which is due to the slight electrolytic dissociation of boric acid. pH-value and titration value (the latter of which, by the way, can be obtained for nickel solutions only indirectly) are, therefore, not the same. For instance whereas a nickel bath contains about 5 to 25 grams of boric acid per litre, the free hydrogen ion content is only about 0.000,000,1 gram per litre. From this value the pH-number is derived. For the determination of the pH-number the measuring methods described below are employed.

**The Meaning of the pH-Number.**

In order to do away with the ciphers for such extremely low acid concentrations it has been generally agreed to express the values by the negative potential of the number 10, therefore,

| | | |
|---|---|---|
| 10 grams | = $10^{1}$ | grams hydrogen ions per litre |
| 1 gram | = $10^{0}$ | grams hydrogen ions per litre |
| 0.1 gram | = $10^{-1}$ | grams hydrogen ions per litre |
| 0.01 gram | = $10^{-2}$ | grams hydrogen ions per litre |
| 0.001 gram | = $10^{-3}$ | grams hydrogen ions per litre |
| 0.0001 gram | = $10^{-4}$ | grams hydrogen ions per litre |
| 0.00001 gram | = $10^{-5}$ | grams hydrogen ions per litre |
| 0.000001 gram | = $10^{-6}$ | grams hydrogen ions per litre |

To further simplify the matter it was also agreed to leave out the number 10 and the minus mark and to use the remaining number as "pH-number"; pH 6.0, therefore, means $10^{-6}$ = 0.000,001 gram hydrogen ions per litre. Looking over the above table it is at once clear that a high pH-value corresponds to a low grade of acidity (or a low concentration of hydrogen ions) and a low pH-value means a high grade of acidity.

The conclusion is that the pH-number indicates the concentration of hydrogen ions in a solution and is identical with the negative logarithm of this concentration of hydrogen ions.

### Buffering

It is quite clear that solutions, for instance nickel solutions, containing only 0.1 to 0.01 milligram of hydrogen ions in the sulfuric acid, would be very variable; even the passing of the lowest current would completely alter the acidity and the pH-number of the solution. Therefore, to nickel solutions are added a sort of "acidity regulator," i.e. a substance which has the quality of compensating lost hydrogen ions and neutralizing new ones so that the pH-number of the bath remains steady against outside influences and is almost constant. The regulation of acidity in nickel solutions is effected by the addition of boric acid, which is well known to every practical plater. The boric acid, therefore, acts as a shock-absorber, or "buffer" so to speak, for the acidity and weakens the effect of the forementioned influences. The more boric acid there is in an electrolyte the better the buffering, i.e. the more difficult it is to unbalance the pH-number of the solution. A certain substance has a buffering effect only within a certain pH-range. For instance experiments have shown that the effect of the boric acid disappears at the pH-number of about 4.5 to 4.6; at 4.3 to 4.4 pH the buffering effect of the citric acid begins. Thus it is clear that it is of no practical value to add boric acid to nickel solutions working at a pH-number below 4.4.

### The Importance of the Grade of Acidity in Nickel Solutions

It has long been known that it is necessary to check the acidity of nickel solutions. The very first electroplaters used to check the reaction by tasting with the tongue. Later on litmus and congo paper were used for the checking of the acidity, the general rule being that the reaction of the bath was correct if blue litmus paper turned reddish-violet. Red litmus paper must not turn blue otherwise the bath was "alkaline." If red congo paper turns blue the bath is excessively acid. These means of checking the acidity are admittedly inexact, the turning of color taking place within a rather wide pH range, apart from the fact that the resulting color depends on the preparation and the stocking of the paper.

The application of various pH-measuring methods afforded the possibility of studying the effect of the acidity on the working of nickel solutions by laboratory tests and it was found that a more accurate checking (than by means of litmus paper) improved considerably the quality of the nickel deposit. For this reason various simple pH-measuring appliances were introduced into the electroplating industry, and within a short time they were adopted very widely so that to-day it can be said that 70% to 80% of all nickel solutions working under practical conditions are being checked by means of pH-measuring appliances.

### Methods of pH-Measuring.

There are two fundamental measuring methods to be distinguished, viz:—

(1) The electrometric method.
(2) The colorimetric method.

The first-named method has not been employed up to now for electroplating purposes but in connection with scientific research work, and therefore, a detailed description is not necessary in this article, meant for the practical plater.

Of the colorimetric methods we have the reactionmeter with indicator solutions, after Prof. Dr. Michaelis, and the folio-colorimeter after Wulff.

The colorimetric method is based upon indicators. These are organic coloring materials changing their shade according to the grade of acidity of the dissolving agent in which they are dissolved (for instance litmus). It is easily understood that the acidity of the solution under examination can be measured directly by determination of the color shade by means of a comparator scale. The sensitiveness with which the color shade reacts with the alteration of the acidity and also the "turning range" is decisive for the potential use of a certain indicator for a certain purpose. The turning ranges are very different with the various indicators and comprise the whole pH-scale from 0 to 14 so that for every pH-range a suitable indicator can be found.

The apparatus by Prof. Dr. Michaelis employs a number of gauged buffer solutions of different pH-numbers prepared with indicators. The solutions are in airtight tubes which according to their acidity have a different color and the whole number of which forms a color-scale. The solution under examination is mixed with an equal quantity of indicator and compared with the measuring tubes until equality of color has been found. (In the case of colored solutions the color of the solution itself is compensated by a "comparator").

The folio colorimeter after Wulff employs a chemically neutral celluloid strip, impregnated with indicator coloring matter which strip is immersed into the solution under examination for 1 to 2 minutes. The hydrogen ions are then taken up by the celluloid strip and change the color of the indicator. By comparing the shade of color obtained in this way with a gauged color scale the pH-number can be read off immediately. The folio colorimeter is a very ingenious appliance for determining the pH-number and has a very wide use in the electroplating industry. Nevertheless, even this simple instrument is still too complicated for many practical platers and hence the desire to simplify the pH-measurement still further.

### A New Measuring Paper.

After extended experiments a way was found to determine the pH-number in the most simple way with sufficient exactitude by the creation of the LPW-Peha-paper which was first made for the determination of acidity in nickel solutions only and combines the simple handling of litmus paper with the exactitude of the folio colorimeter. The Peha-paper strip consists of a special quality filter paper; it is impregnated with 7 cross stripes of different colors. The wide stripe 1 in the middle is the indicator and the 6 small stripes represent the unalterable comparator scale. The stripes of the comparator scale are of different color in such a way that each color corresponds to the "turning color" of the indicator at the pH-number marked at the side. Thus the pH-number of a nickel solution is measured by immersing the strip in the solution and comparing the altered indicator color with the color scale. The instructions for use are very simple:—

(1) Take out strip with clean dry fingers.
(2) Immerse into the solutions under examination for 1 second.
(3) Shake off the liquid and place the strip on clean white filter paper.
(4) Determine the strip of the indicator scale corresponding or being nearest in color to that of the indicator.
(5) Compare paper-strip with measuring scale and read off pH-number. (Intermediate values to be estimated).

Anybody is in a position to determine the acidity of a certain solution by means of the Peha-paper in a few seconds. The advantages of the Peha-paper as against other colorimetric measuring methods are in short as follows:—

(1) The color proper of the solutions varying considerably is balanced without a special comparator.

(2) The color scale, owing to the kind of packing used, is protected against the influence of light and, therefore, remains intact almost indefinitely.

(3) Any special implements such as glasses, comparator tubes and colors, folios, indicator solutions etc. are dispensed with.

(4) The paper can be gauged for special purposes.

The last mentioned point is important for the following reason. All colorimetric measuring devices are gauged by means of buffer solutions. It can be observed quite frequently, however, that such measuring devices, when measuring nickel solutions, give values which are too high compared with those obtained by electrolytic methods. In other cases the values are too low, a fact, which has already had attention in the technical literature. The measuring value is influenced not only by the salt contents ("salt errors") and the buffering of the solution under examination; exact tests have shown that even the metal itself alters the measuring value in a certain direction. For this influence, hitherto not yet described, it is proposed to use the term "metal error." With the Peha-paper it is possible to gauge the measuring scale not with buffering solutions but with solutions electrometrically adjusted to this special use, for instance for nickel-plating, zinc-plating solutions, etc.

In this way "salt errors" and "metal errors," which hitherto have played an important part with the colorimetric measuring method, can be eliminated.

By using indicators hitherto unknown it has been possible to cut out the dichroism of the **"Bromcresol-purple."**

In order to obtain exact pH-values which can be compared with each other it is necessary to make the measurements with the solutions at room temperature as is required with all pH-methods. In the year 1929 (Trans. Amer. Electrochem. Soc. 56, S. 319) W. Blum showed that the acid number—if the temperature is raised from 25° to 40°—is measured 0.22 pH on the low side (as a consequence of hydrolysis).

Peha-paper is available for various purposes and ranges of measurement:—

(1) Peha-paper I (for normal nickel solutions). Range 5.2 to 5.7 pH.

(2) Peha-paper II (for acid electroplating solutions, except zinc solutions). Range 3.7 to 5.0 pH.

(3) Peha-paper III (for acid zinc solutions). Range 3.7 to 5.3 pH.

The measuring paper for zinc solutions is of special value to the practical plater because other colorimetric methods give very uncertain results with these solutions. In the case of zinc solutions containing mercury even electrometric methods are valueless. Apart from that, it has been possible to bring the pH-range at which acid copper solutions are worked within the field of simple measurement. Thus the complicated methods of titration can be dispensed with. By means of the strips mentioned below the determination of sulphuric acid in acid copper solutions can be carried out within a few seconds with such an accuracy as is sufficient for most practical purposes, an advantage which undoubtedly many practical platers will welcome.

(4) Peha-paper IV for weak copper solutions (solutions for rapid copper deposition) 0 to 10 grams sulphuric acid per liter. Range 1.2 to 3.4 pH.

(5) Peha-paper V for acid copper solutions (ordinary electrodeposition bath etc. also suitable for other solutions). Range 0.9 to 1.5 pH. 5 to 40 grams sulphuric acid per liter.

## II. MEASURING THE PH-NUMBER IN ALKALINE BATHS

### Introduction.

It is known to every electroplater that the pH-number is also named "acid number" and that it indicates the degree of acidity of electrolytic baths. Many a practical plater will, therefore, be surprised to hear of the extension of the pH-measurement to baths containing no acid. The following explanations are meant to show how far alkaline solut ons can be classified by certain pH-values.

### The pH-Value of Water.

It has already been mentioned in the last article that the hydrogen ion ($H^+$) is the bearer of the acid reaction in the same way as the hydroxyl ion ($OH^-$) causes the alkaline reaction. It is further to be recalled that water (both neutral and chemically pure water) contains both ions: $H_2O = H^+ + OH^-$. Therefore, any water contains hydrogen ions and hydroxyl ions, though in extremely small quantity. One litre of water contains 0.0000001 grams hydrogen ions and 0.0000017 grams hydroxyl ions. This fact is termed "electrolytic dissociation" of the water. Further, it has already been said above that for the purpose designating such small concentrations of hydrogen the negative potentials of the number 10 are used and as pointed out above, it is correct to say that the pH-number of chemically pure water, owing to the electrolytic dissociation into $H^+$ and $OH^-$ ions is 7.0. (This number undergoes a slight alteration according to the temperature but this is not taken into consideration in order not to disturb the clearness of the description). The pH-value of 7.0 thus also is the point of absolute neutrality. All solutions with pH-values below 7.0 have an acid reaction; the more acid the solutions the lower the pH-value. It may be well to point out here that the pH-value of the water cannot be measured by means of indicators which themselves are basic or acid owing to the extremely small buffering.

### The pH-Value of Alkaline Solutions.

It is known that by chemical law the product of hydrogen ions and hydroxyl ions in aquatic solutions is a constant number, which expressed by formula means: $H^+ \times OH^- = K$. What will happen if water or another solution is made alkaline by certain additions; (for instance caustic soda = NaOH). The fact is that hydroxyl ions are put into the bath increasing their concentration. In the aforementioned formula, therefore, the quantity of $OH^-$ will rise, but as the product is constant $H^+$ must necessarily fall. We take from this that in baths with an alkaline reaction the hydrogen ions do not disappear altogether (in this case the aforementioned formula would take the value O and would thus lose its validity) but that they only lose in quantity. Therefore, the concentration of hydrogen ions is reduced by the addition of caustic soda and the pH-value of the solution will rise above 7.0. This means, the pH-numbers above 7.0 signify an alkaline bath reaction. The higher the pH-number the more alkaline the reaction of the bath. Thus we understand that the pH-number can also be used for

the determination of the reaction of alkaline solutions. The possibility, of course, has long been known to scientists and in many branches of technical chemistry. In the electroplating field, however, pH values above 7.0 have hardly been used under practical conditions. The following is meant to show to what extent by pH-measurement of alkaline solutions faults can be discovered and a checking of the solution, hitherto not known, can be carried out.

**The pH-Value of Brass Solutions.**

It is well known that the correcting of brass baths, which do not work satisfactorily, is one of the most difficult tasks for the practical man. Frequently, it is possible to put the bath in order by the addition of cyanide of potassium, conducting and metal salts. Sometimes there is no other way open than to dilute the electrolyte and replenish it with new salt. Often, however, this also is of no avail and there is no other way but to empty the bath and prepare a new one. Preliminary experiments with brass solutions proved that faulty working of the baths occurs mainly above a certain pH-value. This fact then led to systematic experiments. These have shown (with LPW brass double salts) that at pH-value 9.8 and 10.2 satisfactory results could be obtained, if the electrolyte had been prepared correctly. Above 10.3 pH spots were noticed. This formation of spots increased with the rising of the pH-number and reached the maximum at a pH-value of about 10.8 and 11.0. The pH-value of the bath being further raised by the addition of alkaline salts, the formation of spots diminished gradually. At a pH-value 12.0 to 12.5, deposits free from spots were obtained, which, however, did not show the rich color which the bath rendered at a normal pH-number of 9.8 to 10.2, but a more reddish appearance similar to Tombac. This series of experiments carried through with various bath concentrations, therefore, led to the following conclusions for the practical plater:

(1) Brass baths (prepared with LPW brass double salts) should not have a pH-value above 10.2, as otherwise the deposits result spotty or discolored.

(2) If reddish deposits are desired which at present quite frequently is the case, they can be obtained by raising the pH-number above 12.5. The preparation of a special Tombac bath is, therefore, not necessary.

For raising the pH-number, alkaline salts (for lowering acid salts or acid) are added to the solution; for lowering the pH-number acid salts or acid are added. If sulphuric acid (which in any case must be diluted previously) is added, care is to be exercised as at the same time considerable quantities of hydrocyanic acid are being developed.

The above observations refer in the first place to baths prepared with LPW Brass Double Salts. Other salts, which were also examined, showed the same results. Only with solutions not containing zinc chloride and not prepared with zinc cyanide of highest purity, the results are somewhat different. With these electrolytes the color changes at once at a pH-value from 10.3 to 10.4 from a brass-yellow to a reddish-yellow. The range of discoloration is thus eliminated in this case; it is, therefore, to be assumed that the interval of discoloration is due to impurities such as foreign metals, which, however, are so small that they can hardly be determined analytically. Apart from that, the discoloration appears also with solutions when they have been worked for a certain time, which is the sign that the aforementioned impurities are contained in the purest anode-brass, so that under practical conditions baths will always show the interval of discoloration.

**The Correct pH-Value of Cadmium Solutions.**

Also in the case of cadmium solutions the pH-measurement is of importance. Systematic experiments have shown that cadmium deposits have the best adherence within the pH-range of 12.0-13.0. Therefore, if a cadmium solution gives deposits which have blisters or are peeling off, then the reason is usually a low pH-number, provided that decomposition of additional brightening salts are not the cause. By adding alkaline conducting salts it is quite easy to correct the solutions. The raising of the pH-number not only improves adherence but gives also a finer crystallization of the deposit.

**The Correct pH-Value of Cyanide Copper Baths.**

The checking of the pH-number is also important with cyanide copper baths. Experience has shown that, especially in warm solutions, free caustic soda is developed comparatively quickly whereby the pH-number is continuously rising. As the hydrogen developing and escaping always carries away the finest particles of the solutions, these particles irritate the mucous membrane considerably (like electrolytic degreasing solutions) at a high pH-number and owing to the content of free caustic soda. The writer has seen a case where a copper bath with a pH-number of 12.0 irritated the operators to a great extent; after having reduced the pH-number to the normal of 10.0 by addition of acid salts, the irritation ceased.

Experiments have shown that the formation of blisters in copper solutions can be eliminated in many cases by raising the pH-number to 11.0. This can be observed especially if the copper bath contains equal quantities of free cyanide and copper. How far this fact applies generally, however, can only be found out by a prolonged study of practical cases.

**The Correct pH-Number of Cyanide Silver Baths.**

Laboratory tests have not shown with certainty the influence of the pH-number on the quality of the deposit. In practice it seems that sometimes baths with a pH-value above 11.8 work less satisfactorily. Also in this case broader data must be collected before a general statement can be made.

**The pH-Value of Other Alkaline Baths.**

Every practical plater knows that electrolytic degreasing baths must have a certain minimum content of free caustic soda if they are to work satisfactorily. This can be checked by measuring the pH-number. Also with alkaline tin and zinc solutions there is an optimum pH-value, which, however, is different for the different bath preparations.

**"Peha-paper" for Alkaline Baths.**

To check the pH-value with alkaline solutions, Peha-papers have been developed. These papers are:

Peha-paper VI for cyanide brass, copper and silver baths. Range 9.5 to 11.0 pH.

Peha-paper VII for cyanide cadmium baths, tombac baths, alkaline zinc baths, alkaline tin baths and degreasing baths. Range 11.0 to 13.5 pH.

Special working instructions give the necessary additions according to the pH-number found. The measurement of the pH-number in alkaline solutions is quite new and the Peha-papers for alkaline solutions afford a valuable method very simple to handle

# Rubber—A Vital Industrial Material

## How Rubber Cuts Corrosion Costs in Manufacturing Plant Operations*

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IF I WERE asked to name some of the most important problems in industry today, I should unhesitatingly put at the top of the list the task of preserving our structural equipment and machinery from corrosion. How enormous the cost of corrosion is we can readily appreciate from the fact that 2,000,000 tons of iron must be replaced every year to make up for corrosion losses. In spite of electroplating, painting, rubber covering and other methods of surface protection, corrosion still costs the world millions upon millions of dollars every year.

I do not need to point out to an audience made up of electroplating experts that one of the most effective methods of protecting steel is to cover it with an electro-deposit of another metal, less subject to corrosion than the steel itself. It is interesting to note, however, that electroplating is appreciated by others as well as those engaged directly in it. Over 6,000,000 pounds of nickel were consumed in 1935 in the form of anodes for electroplating operations.

For steel structures the usual protective coating is paint which is cheap and on the whole satisfactory. For this purpose rubber would be too difficult to apply and entirely too expensive. People are still trying to use paint in many places, however, where it does not give real satisfaction and where rubber would stand up indefinitely. Rubber has great value as a protective coating for chemical process equipment, storage and transportation equipment. Rubber can be used for containers for highly corrosive chemicals, such as hydrochloric acid, phosphoric acid, etc., with perfect safety. It is used successfully to line wood and steel tanks and even tank cars.

A discussion of rubber as an industrial material will be much clearer if the background is understood. For that reason I shall give, first, a description of the history of this interesting and extraordinary material[1], after which I shall explain what we do to rubber to make it useful.

### Occurrence of Rubber

Rubber plants have always grown wild in tropical and sub-tropical Africa, Asia, Madagascar, the East Indies and on many islands of the Eastern Hemisphere. The first to make any use of rubber were the Amazon Indians who smeared their feet with it as a protection against bruises and cuts, used it as a means of attaching feathers and other decorations to the body, as a water-proof container, as torches and also as rubber balls. The story goes that Columbus was watching the natives playing a game of ball

DR. H. H. HARKINS

in Haiti some time between 1493 and 1496, on his second voyage to America. It was remarked that "these balls, when touched lightly to the ground, bounced incredibly into the air."

The most important rubber-bearing tree is called **Hevea Braziliensis,** which is native only to the Amazon lands of South America. The principal wild rubber lands lie along the Amazon and its tributaries in South America and along the Congo in Africa, in a belt along the Equator. All of the rubber used by the world until 1910 came from these wild areas.

The first use for rubber was as an eraser for pencil marks suggested by Joseph Priestly in 1770. Other uses which followed, but prior to Goodyear's discovery of vulcanization, were on rollers and printers' blankets, on carding machines, driving belts, billiard table cushions, rubber fire hose and for general surgical purposes.

The first rubber company in the United States was the Roxbury India Rubber Company formed in 1832. Within a few years several million dollars were invested in the rubber business with factories at Boston, Chelsea, New York, Troy and other places, but with the exception of the Roxbury company, they all failed within one to three years with the loss of every dollar invested. A consumer reaction had set in against rubber articles because they became sticky in warm weather and stiff in the cold.

However, rubber was now definitely in demand. The Amazon jungles sprang to life, commercially. Rubber hunters plied every stream and tributary in ocean liner, launch and canoe. In spite of the short

* From a paper read before the Hartford Branch, American Electro-Platers' Society in Hartford, Conn., November 9th.

[1] An accurate and entertaining history of rubber is embodied in a book, entitled "Rubber" by Howard and Ralph Wolfe.

season for rubber gathering, in spite of the long six months of rain each year, in spite of malaria and hookworm, rubber gathering increased by leaps and bounds.

Para rubber produced in Brazil was one of the best grades. The method of production was crude. The native took his paddle, dipped it in the latex drawn from the rubber tree, rotated the paddle and dried it over a smoky flame made by burning palm nuts or uricuri nuts. He repeated this process until he built up on a single paddle, from 100 to 150 pounds of rubber.

The difficulty of collecting the latex from the wild trees, which grew only 5 or 6 per acre, in a dense, tropical jungle, resulted in an inadequate supply for the leaping demand and by 1910 the price of rubber had risen to $3.06 per pound. Naturally this led to efforts to reduce the cost of production. Finally an English gentleman, **Sir Henry A. Wickham,** proved that it was possible to transplant the Hevea tree in other parts of the world. He transported 70,000 Hevea seeds from the interior of the Amazon region to Kew Gardens, England, where they were planted and in two weeks grew to young Hevea plants which were then sent to Ceylon, where some of them matured into productive trees. Eventually thousands of acres of Hevea were planted in Malaya and Sumatra, and today there are several million acres under cultivation. In 1910, the annual production of wild rubber amounted to 83,000 tons, of which half came from Brazil and the other half from the African Congo. In 1934 over 1,000,000 tons of rubber were produced and only 1.4 per cent came from Brazil, Africa and other wild rubber lands. Today rubber comes largely from Malaya and Sumatra from plantations of 80 to 100 trees per acre, with the trees carefully tended and tapped regularly.

But what caused the enormous increase in demand —the stir in the jungle—the artificial cultivation of rubber? In a word, it was caused by the thousands of uses for rubber made possible by Charles Goodyear's discovery of vulcanization.

**Fig. 1. Photograph of Sir Henry Wickham standing beside a large Hevea tree, one of the original plants sent from the Kew Gardens in England**

Charles Goodyear of New Haven, Conn., did not lose faith in rubber when the early New England companies failed. He continued to work in the belief that there was some way of changing rubber so that its elasticity could be retained at both low and high temperatures. Finally in 1839 one of his experimental attempts was successful. He heated a mixture of rubber, white lead and sulphur, and found that the product lost its tendency to melt and freeze. This process was termed "vulcanization" using as a base the name "Vulcan" the Roman God of Fire.

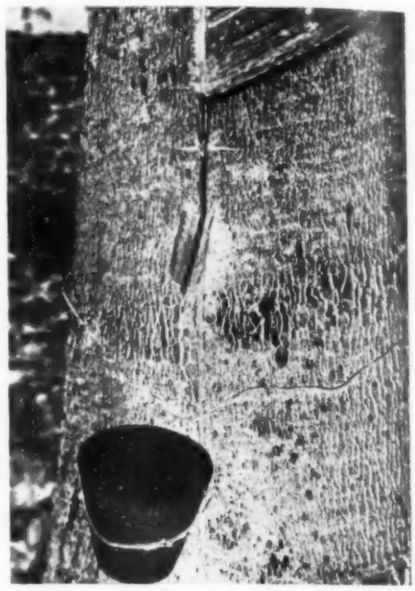

**Fig. 2. This shows how the rubber tree is tapped in order to get the latex. It is important to cut the bark only, without cutting into the cambium layer. Every other day a thin layer of this bark is removed and the latex is collected**

## What Rubber Is

Rubber is a hydrocarbon, the exact structure of which is not known. It is supposed to be a polymerized form of isoprene, consisting of a linear chain of repeating units of conjugated isoprene.

Many attempts have been made to produce rubber artificially by polymerizing isoprene but without practical success. The duPont Company has developed a material called "DuPrene," a substance which is very much like soft rubber and in some ways considerably better than soft rubber.

The formula above shows that chemically, rubber is like an olefine hydrocarbon. It is usually less reactive than unsaturated aliphatic compounds. However, it is possible to add various materials to the double bond just as in the aliphatic series. Thus one can add HCl to the double bond. Also one can add chlorine to give chlorinated rubber, a product which is attracting considerable attention as a corrosive resistant paint base.

In soft, vulcanized rubber only a few of the double bonds have been saturated with sulphur, while in ebonite they are all saturated with sulphur.

## Vulcanization

Although the types of vulcanizates made today are considerably better and although the time required to secure vulcanization has been greatly reduced by the use of organic accelerators, nevertheless, vulcanization is still the same in principle and resembles closely the original process of Goodyear.

We define as the coefficient of vulcanization the parts by weight of sulphur in chemical combination with 100 parts by weight of the rubber hydrocarbon. What we term soft rubber has a coefficient of 0.5 to 3. This type of rubber is used for laboratory rubber tubing, garden hose, automobile tires and similar articles. At high coefficients of vulcanization the tensile strength diminishes to 300-500 pounds per square inch and then begins to rise again until it may reach a value of 10 to 12,000 pounds per square inch.

Rubber, having a coefficient of 30 to 47, is termed "hard" rubber; "ebonite" has a coefficient of 47. The products having a coefficient of 8 to 25 are called semi-ebonite or semi-hard rubber which is intermediate between soft and hard rubber, and has some of the characteristics of leather. It is used between steel and hard rubber to secure an impact resistant hard lining.

Almost any finely divided material may be incorporated into rubber in addition to sulphur and accessory vulcanizing ingredients. It is obvious, therefore, that the physical and chemical characteristics of rubber with any coefficient of vulcanization may be varied. Thus, if we consider the entire vulcanization curve in relation to the compound ingredients, we see that an almost infinite number of products can be made.

### Chemical Resistance

Below is a list of the classes of chemicals which may be handled satisfactorily with rubber. Rubber is inert toward these chemicals and steel containers lined with rubber will stand up in contact with them for a very long time whereas without the protective rubber coating, the steel would be quickly destroyed in many cases.

1. **Inorganic acids,** including hydrochloric, phosphoric, hydrofluoric, fluosilic, hydrobromic, and dilute sulphuric. The strongly oxidizing acids, such as concentrated sulphuric, chromic and nitric cannot be handled with rubber.

2. **Organic acids** like acetic and formic can be handled satisfactorily with specially compounded hard rubber with all concentrations at atmospheric temperatures but not at higher temperatures.

3. **Inorganic salt solutions,** including calcium, chloride, aluminum chloride, ferric chloride, etc. Rubber will stand up indefinitely in sea water, being used by the United States Navy for covering propeller shafts, pipe linings, etc. Rubber lined equipment is also used in the tanks where sewage and ferric chloride are mixed in sewage disposal plants.

4. **Inorganic bases,** while not corrosive to steel and iron, may nevertheless become contaminated with iron if kept in contact with it. Rubber is unaffected by inorganic bases, preventing metallic contamination which is injurious to industrial products such as rayon.

5. All types of rubber are inert to **alkaline hypochlorite solutions** which makes it an ideal material to be used for linings of tanks, containers, etc. in the laundry industry and the textile bleaching industry. For the paper and pulp industries which use large quantities of water containing chlorine, a special type of hard rubber is provided which will handle saturated chlorine water solutions satisfactorily.

6. Rubber is very durable in contact with most **plating solutions;** the exceptions are those solutions containing chromic acid or nitric acid.

### Types or Classes of Corosion

(According to F. N. Speller)

1. **Atmospheric Corrosion.**

Eighty per cent of the steel in use falls in this category. This is the field for paints and for electroplated articles. Rubber, as such, has only a limited application here.

2. **Under-Water Corrosion.**

Rubber covering is excellent here. As previously stated, rubber is used on many propeller shafts to prevent corrosion.

3. **Underground Corrosion.**

Millions of tons of pipe are used underground in oil well construction and water, oil and gas lines. Rubber is very durable underground. Pieces of rubber buried underground for fifteen years have been found to be in good condition. Only a small amount of rubber is being used on pipe lines underground at the present time, but it is anticipated that it will find an extensive use for this purpose.

4. **Chemical Corrosion.**

This includes corrosion by many chemical solutions and vapors; also by acids, salts, bases, etc. With certain chemicals such as concentrated nitric or chromic acids, plain steel or its alloys unprotected may be used. In most other cases a protective covering is required, unless use is made of expensive stainless steels.

This is the field where rubber finds its most extensive application as a corrosion resistant covering.

5. **Electrolytic Corrosion.**

Rubber is a good insulator, as well as a corrosion resistant material and finds extensive application in this connection.

Having now considered the main classes of corrosion, together with the types of chemicals toward which rubber is inert, we may next proceed to a consideration of the technique involved in applying rubber to surfaces to protect these surfaces from corrosion.

### Tank Construction

The first factor to consider in rubber lining a tank is the construction of the tank itself. We cannot use any old sort of tank. The metal must be free from porosity, at the welds and elsewhere. Metallic arc welding is commonly employed, but acetylene or other types of welding may be used. Butt welding can be used, but corner welding is preferable. How important this construction of the tank is we can judge by a statement made by S. A. Brazier in a recent issue of the Rubber Age (London). He said, "In view of the fact that the rubber forms the anti-corrosive lining, and that the main function of the metal shell or pipe is to give rigidity and strength, it might be thought that the construction of the metal parts which are to receive the rubber is not a matter of vital importance. In point of fact, however, the condition and construction of vessels which are made for **rubber-lined equipment** forms one of the major problems of the rubber manufacturer and by far the greatest proportion of failures can be directly attributed to troubles brought about by an unsatisfactory condition of the metal prior to its being covered. This point is now being appreciated by the larger user, but further cooperation, and the better education of the maker of metal equipment, are points which are vitally important and are still very desirable."

1. Is rubber suitable for the job?

If so, the specific compound most suitable for the service must be prepared and applied. The lining is usually made by combining 5 to 10 thin sheets to give a homogeneous sheet. By using several plies the presence of pinholes in the lining is avoided. In one

sense the application of rubber to a surface to protect against corrosion is similar to electrodeposition. In both cases the protective layer must be applied in such a way that the covering will be free from pinholes and firmly adhered to the surface. Other factors of importance are:

2. Adhesion to container wall, at all temperatures.
3. Resistance to changes of temperature.
4. Impact resistance at low temperatures.
5. Contamination of liquid.
6. Cost and length of service.
7. Lining applied in field or factory.
   a. Soft rubber.
   b. Hard rubber.

### Properties of Hard Rubber

The thermal conductivity of rubber at ordinary temperatures compares favorably with asbestos. In

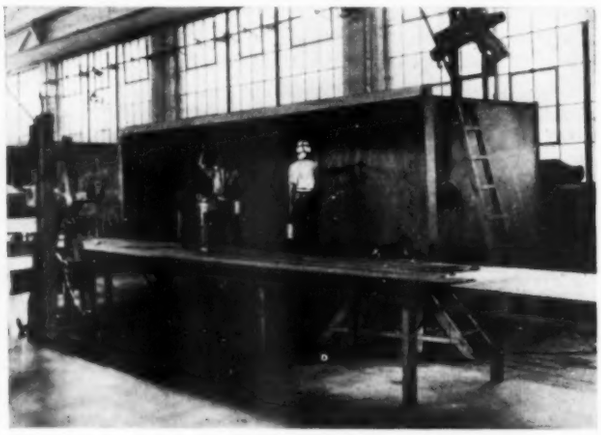

**Fig. 3. Sand Blasting Tank and Applying Adhesive**

the case of plating tanks lined inside with hard rubber, this heat insulating property is decidedly advantageous.

The coefficient of linear expansion is about seven times that of steel. The tensile strength and the elongation vary greatly depending upon the coefficient of vulcanization and also upon the compounding ingredients.

The difference in the coefficients of expansion of steel and hard rubber, gives rise to a problem in the construction of hard linings. In applying hard rubber successfully to large steel surfaces, one must bear in mind two factors.

(1) The lining must not crack due to temperature changes. This factor is important, since there is a big difference between the coefficients of expansion of steel and of hard rubber.

(2) The lining should not be easily fractured by the impact of objects which may fall into the tank. This resistance to impact should be good over a considerable range of temperature.

There are several combinations of different types of rubber available for various applications. Below, four such combinations are described, designated as No. 1, 2, 3 and 4.

No. 1 is a hard rubber-steel combination which has good resistance to impact but is impractical, owing to the difference of the coefficients of expansion of steel and hard rubber.

No. 2 consists of hard rubber, soft rubber and steel. This if properly applied has good resistance to temperature change, and will not crack as a result of heating and cooling; the difference in expansion is compensated by the intermediate layer of elastic soft rubber.

No. 3 consists of soft, hard, and soft rubber and steel. This is an alternative to No. 2 and will not fail because of temperature changes.

In either No. 2 or No. 3, the layer of hard rubber is separated from the steel by resilient soft rubber. If we strike the lining this resilient soft rubber will be displaced and thereby the hard rubber will be moved suddenly through a slight distance. In many cases, especially at low temperatures, the blow may be sufficient to crack the hard layer. Where high impact resistance over a temperature range is not required, either No. 2 or No. 3 is very satisfactory.

No. 4 consists of hard rubber, semi-ebonite and steel. This lining has a high chemical resistance and good impact resistance over a wide temperature range. Semi-ebonite has enough elasticity to prevent the hard rubber from cracking, due to temperature changes. It has, however, enough rigidity at all temperatures to protect the hard layer against impact. The superior impact resistance of No. 4 construction known commercially as "Super Duroline" is very marked when this coating is used on a rigid tank. If the metal wall of the tank is flexible, the conditions are altogether different.

### Lining Operations

The first step is to clean the tank in order to remove all traces of scale, rust, dirt or grease. This is usually accomplished by sand-blasting (blast cleaning).

The next step is to apply the adhesive shown in Fig. 3. This step resembles a paint job, as the adhesive may be applied by brush or by spray. After a uniform coat of adhesive has been applied and allowed to dry the next step is to apply the rubber.

A calendered sheet of rubber, say ⅛" thick, is prepared on a rubber calender, plying together 5 to 7 sheets of rubber. It is then rolled into place on the tank, care being taken to avoid trapping air between the metal and the rubber. After the rubber is in place the tank is ready for vulcanization.

**Fig. 4. A Vulcanizing Tank**

The tank may be cured in open steam under pressure, in air, or in air plus ammonia gas. After curing, the tank is subjected to an electrical test to make certain that no pinholes or other flaws are present. If there are no flaws the tank is ready for shipment.

### Hard Rubber Lined Plating Tanks

There are several advantages in using rubber lined plating tanks. Rubber is satisfactory for all types of plating solutions except those containing chromic or nitric acid. It is stable in contact with copper, nickel, acid zinc, cadmium, brass and gold solutions. It is

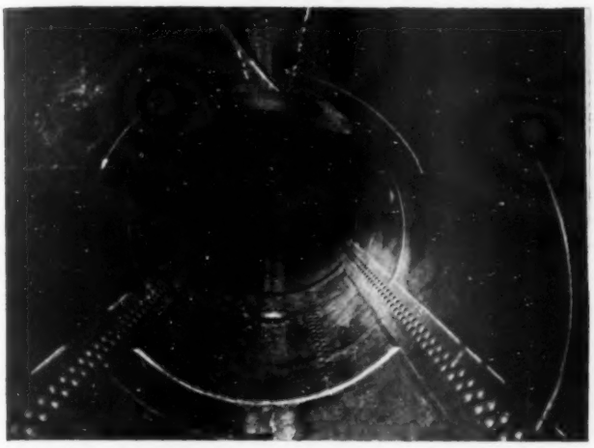

**Fig. 5. A Typical Way to Handle Acid in Bulk—the Rubber Lined Tank Car**

also useful with sulphuric or hydrochloric acid. One plater in Connecticut recently spoke to us about a tank which had been lined inside with rubber four years ago. It had given continuous service with hydrochloirc acid and the rubber was still in excellent condition. The plater said that he wanted to send the tank back to the factory and have a new steel tank built around the rubber! He should have had this tank lined both inside and outside with rubber.

Since cleanliness is such a vital consideration in the electroplating plant, it is all the more necessary to be sure that the tanks do not leak. Wooden tanks, especially if they are operated at other than room temperature may probably be purchased at the lowest original cost. However, it is necessary to provide an appropriation for drip pans because they may be needed within a short time.

Lead linings are used in many chemical plant operations. Rubber has in many instances displaced the lead, but it cannot displace lead entirely as a corrosion resistant lining. In many situations lead is indispensable. In deciding between lead and rubber, the following should be borne in mind. If the corrosive solution being handled is not a strong oxidizing agent such as chromic acid or nitric acid and if the temperature involved is not over 212 deg. F., rubber has definite advantages, particularly in the case of cleaning tanks and plating tanks.

(1) Rubber is not only corrosion resistant, but also is a good insulator. Therefore, rubber will eliminate stray electrolysis which so frequently occurs in lead-lined tanks when anodes touch the lining or the metal coils, or when racks or plated work touch the lining or coils.

It is a proven fact that there is a 15-25% current loss in lead-lined tanks. This loss is greater the higher the temperature and the higher the current density. The loss of current in itself is not so bad in many cases, as the fact that due to this loss, the electroplater is unable to maintain a constant current density, so essential to secure a good electrodeposit in the specified time.

(2) Acid solutions containing soluble chlorides will attack lead, causing the lead lining to deteriorate, and also resulting in contamination of the plating solution. This does not occur with rubber.

(3) Rubber is a heat insulator and where it is desired to maintain a constant temperature by applying heat to the solution, this property of rubber is an advantage, resulting in a saving of steam and permitting more uniform control of temperature.

(4) When lead is heated it expands, but when cooled it does not return to its original shape. This results in buckling of the lining. This is a serious defect of lead in plating tanks, if one is working with hot solutions, since it may result in the lead contacting the anodes or cathodes used in the plating circuit.

Moreover, alternate heating and cooling of lead may lead to embrittlement causing leaks. When a leak develops in a lead lined tank, the corrosive solution is free to act on the entire tank wall, either steel or wood. This may result in serious injury to the tank before the leak is discovered. When rubber lining is damaged to give a leak, corrosion is confined to the point of injury, as a result of the fact that the rubber is bonded to the metal with a corrosion resistant adhesive.

(5) Lead linings do not necessarily perform in a uniform way. I know of one firm who lined three acid storage tanks with lead in 1929. Two of these tanks are still in good condition; one of the tanks has leaked at the joints ever since the lining was put in.

(6) If you agitate the liquid content of a tank by air or other means, this gives rise to vibration of the lead which results in embrittlement, leading to leaks. Rubber is free from this objection.

(7) Lead linings are much heavier than rubber linings. Consequently tanks lined with lead have to be more carefully supported than rubber-lined tanks. Lead tends to flow or sag under its own weight, especially at elevated temperature. This is a very serious objection to lead in deep tanks. Again rubber is free from this objection.

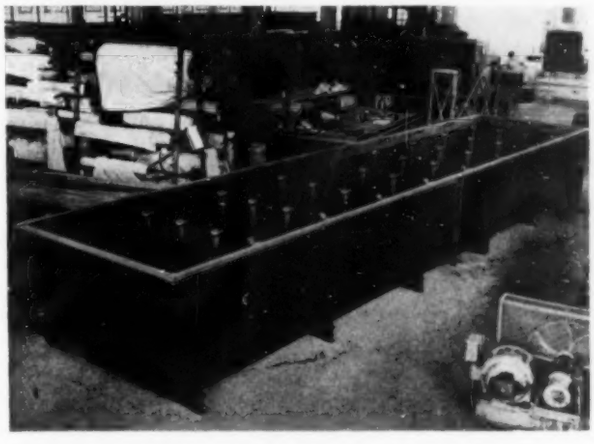

**Fig. 6. A Plating Tank Lined with Hard Rubber**

(8) In 1926 Mr. Harlan A. Depew (I.R.W., 1926, page 129) compared lead and rubber linings to determine which material was more economical as a lining for a lithopone leaching tank. The condition was 20-25° Baume sulphuric acid at 60-70° C. The

lead lasted 18 months and was repaired 13 times. The net cost of the lead was $450. The net cost of rubber was $439. He came to the conclusion that rubber could replace lead for this service. As a matter of fact, lead lining today could be installed on this type of job for about half the price of rubber. However, we can do a much better lining job with rubber now than in 1926, and we know that rubber would last for a much longer time than 18 months in contact with dilute sulphuric acid at 70° C. Moreover, the frequent repairs and shut-downs necessary with lead linings under such conditions would be practically absent with rubber linings properly installed.

There is also the important point that rubber is guaranteed to give economical service while lead is not.

### Plating Tank Construction

Here illustrated is a properly constructed rubber lined plating tank made of ⅜" thickness full weight steel plate throughout. Note the 3-inch angle plate around the top of the tank. The tank is 352" long, 40" deep and 72" wide and is made in two sections, with end of each sect on having an angle flange drilled for bolts.

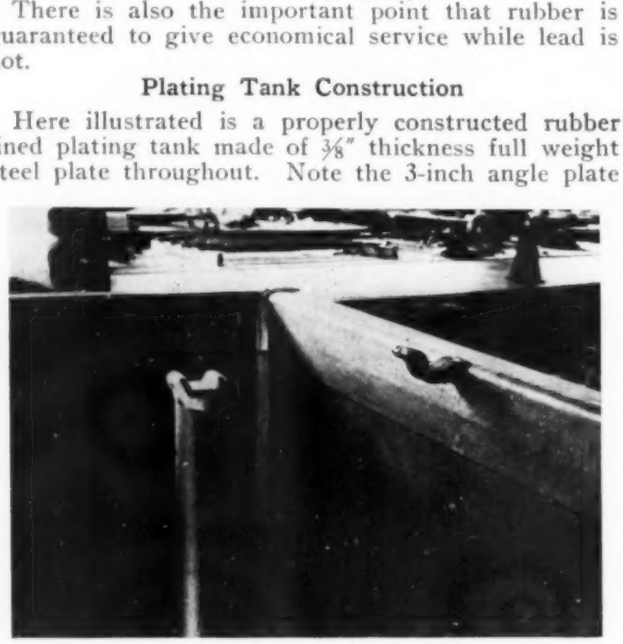

**Fig. 7. A rubber-lined plating tank which represents the "U. S." conception of the proper way to construct a tank and line it with rubber**

The tank is supported by six, 6", 10.5 lb. channels spaced at 68" intervals. Welded to these channels and to the angle iron at the top of the tank we have 12, 3" x 4" x ½" gusset plates, six on each side. The tank is therefore firmly supported and braced to prevent warping or bending and to insure rigidity.

Note further the 24 anode bar supports. These are constructed of 2" full weight steel pipe welded directly to the bottom of the tank. There are also 16 anode bar clips.

The tank is lined with 3/16" thickness of impact resistant hard rubber lining, so compounded as to eliminate the danger of impurities getting into the plating solution. In addition, the anode bar supports and clips are covered with additional ⅛" thickness of soft abrasion resistant rubber, adapted to give additional protection to the hard rubber at these points, and also to insure that each bar support will tolerate a load of 600 pounds. In addition, note that there is an extra bumper strip of soft rubber around the top of the tank, running down on the inside for a distance of 6". This serves to protect the edges of the tank which may be subjected to mechanical abuse; furthermore, it protects the rubber at the solution line, the most vulnerable point of a rubber lining.

### Rubber Cuts Corrosion Costs

The fundamental reason why the use of rubber cuts corrosion costs is that it prevents steel from coming in contact with agents which initiate corrosion—namely, moisture and oxygen. Properly applied and used, its economy results from the fact that steel so protected is serviceable for a very long time at little or no maintenance cost, and furthermore, the user of such a tank may be certain that he can use it year in and year out with absolute assurance of uniform conditions in plating operations.

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## Corrosion of Metals in Soils

A report of the corrosion on non-ferrous metals underground will be published in the November 1936 Journal of Research of the National Bureau of Standards, Washington, D. C. (RP945). This report describes a study under the direction of **K. H. Logan** covering in all about 9,000 specimens, which had been buried, 2,500 of which are still in the ground.

While, in general, most of the non-ferrous materials tested corrode less rapidly than does steel in most soils, no one material appears superior to all others under all soil conditions. To obtain the best results the user should determine which material is best adapted to his soil conditions.

The rates of corrosion of each material differ so greatly under different soil conditions that generalizations are of little practical value. In many soils lightweight ferrous materials will last so long that the use of better materials cannot be justified. Under other conditions the value of continuous trouble-free service is sufficient to justify the use of a non-ferrous material.

## Silver Solution

Q.—We have a tank of silver solution consisting of 190 gallons of which we are enclosing a sample to be analyzed before we deposit the 200 ounces of silver chloride which we have on hand. Please inform us how to bring this solution up to a high standard before we deposit the silver chloride.

A.—The solution submitted has the following composition:

| | |
|---|---|
| Silver | .64 tr. ozs./gal. |
| Free cyanide | .98 ozs./gal. |

Better results will be obtained if the metal is brought up to 2.5 ozs.

To do this add 2¾ ozs./gal. of silver chloride and 3½ ozs./gal. of sodium cyanide. If possible, use potassium cyanide instead of the sodium cyanide as slightly better results will be had. If this is done, use 4.5 ounces per gallon of potassium cyanide.

—G. B. H., Jr.

# Editorial Comment

## Back to Work

THE election is over. As good Americans, whether winners or losers, we smile, shake hands and wipe the slate clean. We are back at work.

To reassure those who feel that the result was a mistake, let us point to a statement by Leonard P. Ayres in a recent issue of the Cleveland Trust Company Business Bulletin, that "we are in a recovery movement which has gained strong momentum, and which promises to continue for many months to come . . . It is still predominantly a consumer goods recovery. Capital goods, construction and export trade are still on levels far below normal, accounting for most of our unemployment. Nevertheless, there should be no sharp changes between the conditions of late 1936 and early 1937."

Farther off than that, no authority can safely predict, but in this well-considered statement there is a measure of comfort.

## Copper Markets

THE bell-wether of the non-ferrous metals, copper, is always watched more closely, marketwise than any other and during the past few months, it has received even more attention than usual.

It is common knowledge that the copper market is better than it has been for years. Stocks of metal have been declining, rate of consumption rising, and although production has also been increasing, the rate of consumption is keeping up. However, the price of copper seems to have lagged behind the market situation, so that for weeks foreign prices have been above American, in spite of a 4-cent duty in this country.

To a large extent this condition has been caused by the reluctance of American producers to be taken on a "joy ride" by foreign speculators. The most important factor in the well-being of the industry is a fair price for the metal. The next factor, almost equal in importance, is stability. It is better to have the lowest fair price maintained steadily than a very high price subject to sharp declines. There is also a strong feeling among the large, low-cost producers that a high price lets in high cost mines, unduly expanding production and resulting in fresh surplus stocks.

The tendency of the copper market seems to be upward, but wisely enough, it is being held in check for the present at any rate, by the desire of the largest and most responsible producers for a stable market.

## The Social Security Act

THE Social Security Act is full of questions which every employer and employee must answer. The daily press has been filled with arguments pro and con; millions of words have been uttered and printed on its rights and wrongs. The fact remains, the Act is here.

The first question is, "To whom does the Act apply?" The answer is, to all employers and all employees except agricultural labor, domestic service in a private home, casual labor not in the course of an employer's trade or business, officers and crews of vessels, government employees, employees of non-profit-making organizations, and employees over 65.

For 1937, 1938 and 1939, the tax will be 1 per cent of the payroll from both the employer and the employee. The employer will transmit this tax (deducting the contribution of the employee from his pay) to the proper authority in his district. No payments are to be made on wages in excess of $3,000 a year for any individual.

Benefits from such payments, penalties for non-payment and a host of other details are explained in full in the literature of the Social Security Board which can be obtained from any post office.

## The Extent of Plating

AN interesting figure comes to our attention from the International Nickel Company. They estimate that approximately 36,000,000 sq. ft. of other metals were coated with nickel in 1935 by the 6,500 plating establishments in the United States and Canada. Truly the nickel plating industry covers a large area!

A figure that will probably have a more practical meaning to those engaged in electroplating is that nickel plating absorbed 10 per cent of the output of the International Nickel Company, or a total of about 14,000,000 pounds, of which between 7,000,000 and 8,000,000 were consumed in the United States; 6,600,000 lbs. in the form of anodes, the balance as salts.

Contrary to the popular impression and the fears of the industry some years ago, the advent of chromium plating greatly increased the use of nickel by calling for a thicker coating of nickel under the chromium than was formerly customary for the bare nickel, to protect the plated metal from corrosion and to assure adherence of the chromium.

The outstanding example of this practice has been the plating of automobile parts. When other manufactured products are brought up to the best automobile standards we shall see new records for the "extent" of plating.

## Chromium Plating Hazard

SOME weeks ago an address was made at a public health symposium by Dr. Lawrence T. Fairhall of Harvard University, in which according to the daily press, he stated that "chrome ulcers" were increasing and that more than half the men engaged in the chromium plating industry had nose ailments. We tried at the time to obtain a copy of Dr. Fairhall's paper but without success. Consequently, we can discuss the above statements only as press reports.

To us the claim that more than half of the men engaged in the chrome plating industry are afflicted, seems a gross exaggeration. That chromium plating is hazardous, no one has ever denied. In fact it is known to be so hazardous that special, down-draft exhaust is always provided. The great hazard is guarded against and no chances are taken in any reputable shop or plant. We venture to state that chromium sores and ulcers are much less prevalent than ailments in other industries in which the dangers are not so obvious.

We should be interested to know how and where Dr. Fairhall obtained his statistics.

# New Books

**List of A.S.T.M. Standards and Tentative Standards.** Published by the American Society for Testing Materials. Size 6 x 9, 28 pages, paper bound. Price 25c for single copies and less on quantity orders.

This List of Standards includes Specifications, Methods of Testing, Recommended Practices, Definitions of Terms, Charts and Tables.

**Handbook of Chemistry and Physics.** Edited by Chas. D. Hodgman. Published by the Chemical Rubber Publishing Co. Size 4¼ x 6½, 2,028 pages. Price $6.00.

The Handbook is now in its 21st edition and its 23rd year of publication. It includes an increase of over 175 pages of new material. New features are included in the mathematical section. The section on laboratory arts and recipes has been completely revised and enlarged; also the photographic section. New data is included in the section on commercial plastics.

Other important features are a table of physical constants of over 5,500 organic compounds and a formulae index of organic compounds.

**Standard Metal Directory.** Published by the Atlas Publishing Co., New York. Size 6 x 9, 687 pages. Price $10.

The 1936 (7th) edition. The general section lists more than 10,000 of the principal blast furnaces, steel mills, foundries, smelters, manufacturers, etc. in the United States with detailed reports on each firm. In addition there are special lists of ferrous and nonferrous foundries, sheet metal stamping plants, metal rolling mills, copper smelters and refiners, copper brands, lead smelters, lead brands, zinc smelters and zinc brands, aluminum smelters, antimonial lead smelters, babbitt and solder manufacturers, ingot metal manufacturers, galvanizing plants, die casting plants, storage battery manufacturers, new metal dealers, importers of ores and alloys, scrap iron and scrap metal dealers, exporters of scrap iron and scrap metal, used structural steel dealers, automobile manufacturers, a special list of railroads and their purchasing agents and other lists.

**Technology of Aluminum and Its Light Alloys,** by A. Von Zeerleder. Published by Gustav Fock, New York. Size 6 x 9½; 301 pages. Price $5.50. Translated from the second German edition by A. J. Field.

The book deals with the characteristics of the metal and its application to industrial arts, with information on methods of manufacture. The material includes metallography, melting, casting, rolling, extrusion, drawing, forging, welding, riveting, surface treatment and machining.

A summary of the contents is as follows: Theory of Alloys; Alloys of Commercial Importance; Properties and Methods of Testing; Physical Properties; Mechanical Properties at other Temperatures; Corrosion Resistance; Forging; Furnaces and Furnace Operations; Melting Furnaces; Annealing Furnaces; Temperature Measurement and Control; Thermal Treatments; Rich Alloys; Casting; Riveting; Ingot and Billet Casting; Permanent-Mould Cast; Die and Press Casting; Sand Casting; Sheet Rolling; Extrusion and Drawing of Tubes and Sections; Press Work; Spinning, Wire Production; Welding and Soldering; Machining; Aluminum Powder Manufacture; Surface Treatment and Protection; Selected Bibliography.

**Chemical Engineering Catalog.** 1936 Edition. Published by Reinhold Publishing Co. New York. Size 8½ x 11, 913 pages. Distributed free to firms interested or related to the chemical industries. To all others, price $10.00.

This catalog, now in its 21st annual edition, needs no explanation or introduction as it is now one of the standard annuals of the chemical industries, being labeled as "The Buyers' Guide of the Process Industries." The volume includes, in addition to the catalog information of equipment and supplies for the chemical industries, an index of trade names, a list of chemicals and raw materials and a section devoted to technical and scientific books.

## Technical Publications

**Micro-Plasticity in Crystals of Tin,** by Bruce Chalmers. Published by International Tin Research and Development Council, 149 Broadway, New York.

**Sulphur Base Cements Protect Sewage Works,** by Dr. C. R. Payne, Mertztown, Pa. Useful for industrial plants, acid proof floors, etc. Municipal Sanitation, November, 1936.

**Determination of the Brinell Number of Metals,** by Serge N. Petrenko, Walter Ramberg and Bruce Wilson. Research Paper RP903. Part of Journal of Research Volume, 17, July 1936. National Bureau of Standards, Washington, D. C.

**Nickel in Your Business.** Publications on non-ferrous metallurgy as follows, by the International Nickel Co., 67 Wall St., New York.

No. 302. Some Effects of Nickel on Bronze Foundry Mixtures.

No. 303. Brief Outline Covering Improved Physical Properties of Nickel-Containing Bronzes.

No. 401. Casting Properties of Nickel Bronzes.

No. 402. Foundry Practice for Nickel Silver

No. 403. Molding Sand Characteristics for Nickel Bronzes, Nickel Silvers and Monel Metal.

No. 501. Strength and Aging Characteristics of the Nickel Bronzes.

No. 502. Physical and Casting Properties of the Nickel Silvers.

No. 503. A Method for Study of Shrinkage and Its Distribution in Castings.

Copper-Nickel Tubes—Their Advantages for Steam Condensers.

Research Brings a New Bearing Material.

**Silver:** Its Properties and Industrial Uses. Circular C412, by B. A. Rogers, I. C. Schoonover and L. Jordan. National Bureau of Standards. Obtainable from the Superintendent of Documents, Washington, D. C., Price 10c.

**Zinc Coating (Hot Galvanizing).** A Bibliography Compiled by Victor S. Polansky, Technology Dept., Carnegie Library of Pittsburgh. Mimeographed by Pittsburgh Steel Company Fellowship at Mellon Institute of Industrial Research, Pittsburgh, Pa.

Contents include the following: General and Miscellaneous; History and Development; Galvanizing Procedure; Galvanizing Equipment and Fuels; Effect of Galvanizing; Tests of Coatings; Corrosion and Corrosion Resistance; Galvanized Products; Welding; Specifications; Galvanizing Plants; By-Products and Their Recovery; United States Patents; British Patents.

## Government Publications

**Federal Specifications for Bronze, Manganese; Bars, Plates, Rods and Shapes.** Proposed Revision, QQ-B-721a. Send comments or criticisms by Dec. 24 to Federal Specifications Division, Room 751, Federal Warehouse, 9th & D Sts., S. W., Washington, D. C.

**Tinned-Steel Ice Cream Cans.** Simplified Practice Recommendation R164-36. National Bureau of Standards. Obtainable from Superintendent of Documents, Washington, D. C., price 5 cents.

**Electrolytic Deposition of Metallic Manganese.** A part of Bureau of Mines report of investigations R.I.3322 entitled "Metallurgical Investigations." Obtainable from U. S. Bureau of Mines, Washington, D. C.

**Proposed Trade Practice Rules for Mirror Manufacturing Industry.** Federal Trade Commission, Washington, D. C.

**Consumption of Primary and Secondary Tin in the United States in 1935,** by E. W. Pehrson, John B. Umhau and M. E. Trought. Information Circular 6930. U. S. Bureau of Mines, Washington, D. C.

# Shop Problems

**This Department Will Answer Questions Relating to Shop Practice**

**METALLURGICAL, FOUNDRY, ROLLING MILL, MECHANICAL, ELECTRO-PLATING, POLISHING, AND METAL FINISHING**



## Cadmium on Steel Rings

Q.—We are having some trouble plating ring holders, which is new to us, and will appreciate any suggestions you may have to offer. We now use the following procedure:

1.—Wash in carbon tetrachloride using hand brush.

2—Hang 15 minutes in a solution of P.B. cleaner which is kept just below the boiling point.

3—Rinse in clean water.

4—Place in muriatic pickle to remove rust.

5—Rinse again in clean water.

6—Place in plating tank for 15 minutes, plate at 6 amps. per ring holder.

7—Rinse in clean water which is kept boiling hot then dry in steam oven.

We get a dark plate in the groove. (See sample we are sending under separate cover). We have used pumice and obtain excellent results but this practice is too expensive. We are also sending a sample of our plating solution.

A.—The difficulty is due to improper cleaning at some point in the procedure you mentioned. The following suggestions are given for consideration, but the exact source of trouble will have to be found by actual examination of the shop practice.

After dipping in carbon tetrachloride, the rings should be dried in sawdust. This will absorb the solvent and grease remaining on the steel. The work should not be allowed to dry in the air as a film of grease will remain. Immersion in the cleaner before removal of this solvent film will not completely clean the surface.

The best method for grease removal would be to use a vapor degreaser.

We do not know what the P.B. cleaner is. However, an electric cleaner should be used which will be recommended by any of the manufacturers of cleaning materials. Make the work cathode for about 3 minutes or longer if necessary. Then reverse current for about 5 seconds.

Rinse in clean water that is not used for rinses from the acid dips.

Muriatic dip and rinse are all right. Rinse thoroughly in clean water before going into cyanide solution. A dip in dilute cyanide, about 2 ozs. per gallon and rinsing before going into the plating solution, will neutralize traces of acid.

Inasmuch as you are operating a Udylite solution suggest you send the Udylite company sample for analysis. They will make recommendations to suit the composition of solution originally made up.—G. B. H., Jr., Problem 5,544.

## Nickel Analysis

Q.—We have recently made up a new nickel solution for small screws and basket work, as described below: 55 gallon tank (water); used 27½ lbs. double salts, 13¼ lbs. single salts, 6¼ lbs. ammonium chloride and 6¼ lbs. boracic acid.

Will you please let us know what pH and nickel content, so if O. K. to keep formula for further references. We have sent to you under separate cover 1 bottle of this solution for your analysis.

A.—The composition of the sample of solution submitted is:

| | |
|---|---|
| Nickel | 1.38 ozs./gal. |
| Chloride, as ammonium chloride | 1.81 ozs./gal. |
| pH | 6.4 |

Your original solution contained 2 ounces of nickel, and 2 ounces of chloride per gallon.

To bring it back to this composition add 3 ounces per gallon of single nickel salts and one-fifth ounce per gallon of ammonium chloride.

The pH is too high at present. This can be approximately corrected by adding 3 fluid ounces of sulphuric acid to each 100 gallons of solution. However, the pH should be checked after above additions are made.

The above solution is satisfactory for light deposits and where fast plating is not desired. For heavier deposits and faster plating a solution composed of:

| | |
|---|---|
| Single nickel salts | 14 ounces |
| Double nickel salts | 4 ounces |
| Ammonium chloride | 3 ounces |
| Boric acid | 3 ounces |

can be used successfully.

If high purity rolled nickel anodes are being used a chloride content of at least 3 ounces per gallon should be maintained to obtain proper anode corrosion, in either this or the first solution.—G. B. H., Jr., Problem 5,545.

## Nickel Solution for Stereotypes

Q.—I am a stereotyper employed in a printing plant, where we nickel lead plates.

The solution we use was made by a former employee about a year ago, and although we are still getting good results I am anxious to be prepared in case any trouble should develop.

The tank holds 100 gallons of solution—single and double nickel salts. Can you give me the proper measure-

**USE THIS BLANK FOR SOLUTION ANALYSIS INFORMATION**

**Fill in all items if possible.**

**Date**.....

**Name** ..... **Class of work being plated:** .....

**Address** ..... **Volume used:** .....

**Employed by:** ..... **Solution depth:** .....

**Kind of solution:** ..... **Cathode surface, sq. ft.:** .....

**Tank length:** ..... **width:** ..... **Kind of anodes:** .....

**Anode surface, sq. ft.:** ..... **Distance from cathode** ..... **Original formula of solution:** .....

**REMARKS: Describe trouble completely. Give cleaning methods employed. Send small sample of work showing defect if possible. Use separate sheet if necessary.**

**NOTE: Before taking sample of solution, bring it to proper operating level with water; stir thoroughly; take sample in 2 or 3 oz. clean bottle; label bottle with name of solution and name of sender. PACK IT PROPERLY and mail to METAL INDUSTRY, 116 John Street, New York City.**

ments for making up a new solution? Also for a test, etc.:—

Can you suggest any cleaners for cleaning lead plates, at the present we use pumice, cleaning by hand, as due to the softness of the lead we cannot use a brush, as it scratches the face of the half-tones; **(lead).**

A.—Stereotypes can be nickel plated in a warm nickel solution of the following composition:

| | |
|---|---|
| Single nickel salts | 27 ozs./gal. |
| Nickel chloride | 6 ozs./gal. |
| Boric acid | 4 ozs./gal. |
| pH | 5.8 |

Run at a temperature of 130 deg. F. Use 99 plus rolled nickel anodes, bagged.

This is a faster plating solution than the room temperature nickel using double salts. Also, it gives a ductile and tougher deposit. The room temp. nickel is more brittle. For press work the former type of deposit is found superior.

Methods of testing this nickel solution can be found in the 1936 edition of the Platers' Guidebook, put out by the **Metal Industry.**

Cleaning of the lead plates is best done in an electrolytic cleaner using a compound supplied by any reliable manufacturer and recommended for the purpose.—G. B. H., Jr., Problem 5,546.

## Protecting and Coloring Bronze Tablets

Q.—We would appreciate any information you can give us with reference to the proper treatment of bronze casting such as tablets with oil after oxidization. We are particularly anxious to know the best kind of oil to use as a protection against weathering, and how to apply it. Is the tablet heat treated?

Also, can you throw any light on the proper procedure to follow in getting a durable verde green color on tablets? We want to obtain a green (solid); also a green superimposed on a brown color such as is obtained with liver of sulphur.

A.—The tablets to be protected against weathering can be treated with a drying oil, such as boiled linseed oil. This will give a hard elastic film that is transparent and which will give added life to the metal surface.

It is also possible to use a hard resin lacquer, such as a bakelite type lacquer for the same purpose.

In the case of either of the above treatments, the tablets should not be polished or scrubbed with abrasive powders, as the coating will then be removed and its value lost. If cleaning is necessary, a damp rag only should be used.

To produce a verde green color, the following solution is good:

| | |
|---|---|
| Copper nitrate | 4 ozs. |
| Ammonium chloride | 4 ozs. |
| Calcium chloride | 4 ozs. |
| Water | 1 gal. |

The solution is stippled on the work using a bristle brush. After the finish has dried thoroughly it can be used without further treatment or it can be given a light gloss and some additional protection if it is lacquered. If the lacquer coating is waxed and polished with a goat's hair wheel a good final finish is obtained.

—G. B. H., Jr., Problem 5,547.

## Solution Analyses

Q.—I am sending five samples of plating solutions (silver, silver-strike, copper, nickel and brass) and would like you to analyze them.

A.—Analysis of silver strike and regular silver:

| | Strike | Plating |
|---|---|---|
| Silver | .24 | 2.12 ozs./gal. |
| Free sodium cyanide | 1.47 | 2.14 ozs./gal. |

The silver strike is low in cyanide. Add 5½ ozs./gal. of sodium cyanide. The plating solution could contain a little more metal and cyanide. Add ½ oz./gal. of silver cyanide and 1 oz./gal. of sodium cyanide (or if possible use potassium cyanide 1 1/3 ozs./gal.)

**Brass**

| | |
|---|---|
| Copper | 2.95 ozs./gal. |
| Zinc | .66 ozs./gal. |
| Free cyanide | 1.97 ozs./gal. |

The free cyanide is somewhat low. Add up to 1 oz./gal. of sodium cyanide, controlling the amount of the addition by the color desired.

**Nickel**

| | |
|---|---|
| Nickel | 4.85 ozs./gal. |
| Chloride, as ammon. chloride | .2 ozs./gal. |
| pH | 6.8 |

The nickel need be only 3.0 ozs./gal. and further additions of nickel salts should not be made. Chloride is much too low. Add 3 ozs./gal. of ammonium chloride. Also 1 oz./gal. of boric acid. The pH can be approximately corrected by adding 1 pint of sulphuric acid per 100 gallons, adding gradually to avoid pitting. Check pH during these additions, to bring to 5.8 to 6.0.

**Acid Copper**

| | |
|---|---|
| Copper sulphate | 24.8 ozs./gal. |
| Sulphuric acid | 3.0 ozs./gal. |

Add 2 ozs./gal. of copper sulphate and 2 fluid ounces per gallon of sulphuric acid.

—G. B. H., Jr., Problem 5,548.

## Stained Nickel

Q.—Can you help us find out how to remove brown, streaky stains that are on some of our nickel plated work (in barrels).

These articles, like sample enclosed, are bright plated and such stains are detrimental to their appearance.

A.—The brown, streaky stains as shown on samples submitted may be caused by several conditions in the plating operation. The cleaning cycle used for preparing work prior to plating should not produce stain on parts or such stain will follow through after plating and can only be removed by stripping nickel deposit.

A too large a load or type of barrel preventing free movement of work during plating will cause stains due to the fact that articles are not receiving a uniform amount of current. In barrel plating parts to be plated should be able to move freely and not trapped in one position as parts nearest cathode contacts will receive more deposit than those that are not.

The articles after plating should be thoroughly rinsed in clean running water and dried in clean, hot hardwood sawdust to prevent staining after plating.

It must be understood that the cathode efficiency in barrel plating is lower than in tank plating and that solution composition should always be maintained at proper strength for most satisfactory results.

—T. H. C., Problem 5,549.

## Streaky Brass Plate

Q.—We have sent you today under separate cover two samples of solution from our two brass tanks and also one frame which was plated in one of these tanks.

This frame is of brass stock, has been buffed, cleaned and plated in the usual way and you will notice there are diagonal streaks on the face, a trouble which we have been having on quite a few of our plain surfaced frames.

A.—Analyses of the solutions:

| | No. 1 Solution | No. 2 Solution |
|---|---|---|
| Copper | 2.27 | 2.51 ozs./gal. |
| Zinc | .85 | .57 ozs./gal. |
| Free cyanide | 3.35 | 2.67 ozs./gal. |

You will notice that the unbuffed backs of the frame submitted shows a "zinc pink" color. This is an evidence of excess zinc and is borne out by the analysis of No. 1.

To correct this condition, add to No. 1 solution up to 1 ounce per gallon of copper cyanide. This addition will reduce the free cyanide by about an ounce and bring it to a better value. At present the free cyanide is too high.

No. 2 Solution shows a more nearly correct composition although the zinc content could be slightly higher, that is about one-tenth ounce per gallon higher. To obtain this would require the addition of only 1¾ ounces of zinc cyanide to each 10 gallons.

Other factors in the operation of a brass solution will of course effect the color as much as the chemical composition. The solutions should be operated at 100 deg. F. for best results. Anodes are preferably of 80 zinc 20 copper composition. The carbonate content should not be over about ten ounces per gallon. Sufficient sample was not available to make a carbonate determination.

Excessive carbonates will cause gassing that will produce the streaking difficulty. Other causes for this trouble are too high a current density. Also having the anodes too long and extending below the work. If a thief is used along the bottom edges of the work (by means of a wire rack) or if the work is agitated with a cathode rocker, streaking can be corrected.

—G. B. H, Jr., Problem 5,550.

# Practical Brass Foundry Digest

By H. M. ST. JOHN

Chief Metallurgist, Detroit Lubricator Company; Associate Editor, METAL INDUSTRY.

**Short Abstracts of Articles of Interest to Practical Non-Ferrous Foundrymen and Metallurgists.**

**Capillarity as a Factor in Foundry Practice.** Albert M. Portevin and Paul G. Bastien, Metal Industry (London), Vol. 48 page 683 (June 19th, 1936).

French Exchange Paper before the Institute of British Foundrymen, dealing with the influence of capillarity and surface tension of the molten metal on penetration of metal into the sand of the moulds. Methods for determining the surface tension of molten metals and previous researches along this line are discussed. The authors describe their own experimental arrangement and the mathematics of its use.

**Same. Second Part (Conclusion).** Metal Industry (London), Vol. 48, page 716 (June 26th, 1936).

Further description of experimental work with mathematical interpretation. A pure surface of molten metal does not wet sand and will not penetrate between the grains. An oxide film, however thin, on the surface of the metal will result in wetting and penetration if the oxide has a metallic character, as is the case with oxides of iron, nickel, cobalt and copper. Aluminum oxide, on the contrary, opposes penetration. A small addition of aluminum is effective in metals which would otherwise penetrate the sand.

**British Non-ferrous Metals Research Association.** Anon. Metal Industry (London), Vol. 48, page 689 (June 19th, 1936).

An account of the Association's meeting and a summary of its sixteenth annual report.

**Future Developments in the Foundry Industry.** H. Winterton. Metallurgia, Vol. 14, June 1936, page 33.

A review.

**Developments in the Foundry Industry During Recent Years.** J. E. Hurst. Metallurgia, Vol. 14, June 1936, page 37.

A review.

**Modernizing the Foundry.** Anon. Metallurgia, Vol. 14, June, 1936, page 45.

A description of developments in several Scottish foundries, producing iron, steel and brass castings.

**Sand Testing and Its Application in the Foundry.** H. W. Dietert. Iron Age, Vol. 138, July 30th, 1936, page 24.

Suggests a comprehensive system for testing and controlling the properties of foundry sand, and discusses the relationship of these properties to casting quality.

**Artistic Bronze Work on New Archives Building.** Anon. Iron Age, Vol. 138, July 30th, 1936, page 30.

Many bronze castings have been used in this new federal building.

**Powder Metallurgy.** Gregory J. Comstock. Metal Progress, Vol. 30, July, 1936, page 49.

A general view of this interesting development.

**Beryllium and Its Alloys.** Jack Delmonte. Metals & Alloys. Vol. 7, page 175 (July, 1936).

A correlated abstract with bibliography. This first installment is a general discussion of the metal and its properties.

**Good Housekeeping in the Foundry Pays Dividends.** E. O. Jones. Foundry, Vol. 64, July 1936, page 22.

For hygenic and psychological reasons dirt and dirt catchers should be eliminated. Compressed air "baths" by workmen should not be tolerated. Ventilation is vital.

**Sand Casting Copper-Silicon Alloys.** H. A. Bedworth and V. P. Weaver. Foundry, Vol. 64, July, 1936, page 24.

Silicon forms a solid solution with copper with a proportional affect on its properties much greater than that of nickel, zinc, tin or aluminum. Standard specifications call for 1 to 5% silicon, with varying small proportions of other metals such as manganese, zinc, iron, and tin. The article refers particularly to an an alloy of 95% copper with 4% silicon and 1% manganese, which for 10 years has been successfully used for sand castings. Melting and moulding practice is described in detail but does not differ greatly from the usual. It is particularly important to avoid interdendritic shrinkage by adequate feeding of heavy sections, the use of high sprues and by pouring hot (1950° to 2250°F), depending upon the section of the casting. The castings are readily machinable, using a lubricant. They may be welded and heat treated. Alloys of this type are very resistant to most types of corrosion.

**New Fields for Zinc Die Castings.** Herbert Chase. Metal Industry (London), Vol. 49, page 11.

Last article of the series; see previous abstracts. A review.

**Addition of Lead to a Tin-Base Bearing Alloy:** Effect on Endurance Limits. John N. Kenyon. Metal Ind. (London), Vol. 49, page 33, (July 10th, 1936). From a paper presented before the American Society for Testing Materials.

In spite of the current prejudice against the presence of lead in tin-base bearing metal, the author finds that the addition of 4 per cent lead to an alloy containing 80 per cent tin, 15 per cent antimony, 5 per cent copper, slightly improves the endurance, does not result in brittleness or shrinkage cavities. It has also been determined that such an addition of lead increases the strength and hardness of the alloy at ordinary temperatures, does not cause crumbling short of 183°C (361°F).

**A Study of Sprayed Metal Coatings.** J. Fassbinder and P. Soulary. Metal Ind. (London), Vol. 49, page 35 (July 10th, 1936). A paper presented at the International Congress of Acetylene, Oxy-Acetylene Welding and Allied Industries.

While this comprehensive paper is meant to apply particularly to the protection of parts made from mild steel, it is also of interest to the non-ferrous industries.

**Beryllium - Copper - Cobalt Alloys.** F. G. Benford. Metal Ind. (London). Vol. 49, page 40 (July 10th, 1936).

The alloy known as Trodaloy No. 1 contains 0.4% beryllium, 2.6% cobalt, 97% copper. It can be produced in castings, forgings, rolled plate and strip and cold-drawn rod and wire. It is particularly suitable for use in welding electrodes and electric soldering-iron tips. Trodaloy castings have a Rockwell B hardness of 92 and will withstand temperatures up to 475°C (887°F) without softening. The tensile strength is about 90,000 lbs. per sq. in., elongation 10%, electrical conductivity 40%.

**Production of Color by Electrolysis.** Jesse E. Stareck and Robert Tatt. Metal Ind. (London), Vol. 49, page 43. (July 10th, 1936). A paper presented at the Cincinnati meeting of the Electrochemical Society.

Copper alloys may be given colors ranging from red to violet by electroplating at low current densities in copper-sulphate baths containing lactic acid.

# Modern Equipment

**New and Useful Devices, Metals, Machinery and Supplies.**

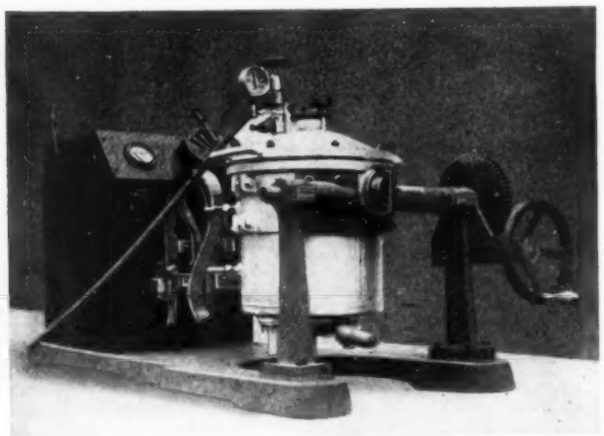
## Electric Furnaces

"Helberger" electric transformer crucible furnaces for research testing and foundry work with temperatures as high as 5500 deg. F., are being sold by Adolphe Hurst and Co. Inc., 330 W. 42nd St., New York, sole agent for the United States and Canada. These furnaces are furnished completely equipped, ready for connection to 1 or 2 phase alternating or 3 phase current. The equipment consists of an 8 to 12 fold, finely regulated and graduated transformer, and the smelting installation includes 3 crucibles, 2 carbon contacts and 1 carbon tube-set with contacts.

A special tilting device facilitates pouring and permits continuous operation without removal of the crucible.

The simple conversion to a carbon tube furnace will give excellent service, it is stated, for experimental work; also in the horizontal position it can be used as a muffle furnace. The furnace can be set up with vacuum smelting or vacuum compression equipment. It is possible to attach a small type furnace for experimental work and the larger type furnaces are furnished with or without such attachment.

The furnaces can be used for melting any metal including high temperature materials, such as tungsten, the precious metals, etc.



Type No. 3 Vacuum Furnace

## New Line of Buffing Compositions

Hanson-Van Winkle-Munning Company of Matawan, N. J. has developed and now offers to the trade a new line of hard, firm tripoli compositions which it is claimed, give maximum results in high speed production, finish and low costs.

These new compositions, Grades 2-D-20, 2-M-125 and 2-M-128 are designed for general buffing on brass, aluminum, copper and die castings. They are particularly recommended for high speed hand buffing and for automatic machine work.

## Alrose Wite-Brass Plate

The Alrose Chemical Company, Providence, R. I., creator of the Jetal Black Process for steel and iron, is now marketing a "white brass" plating solution under the trade name Wite-Brass. This is claimed to be as white as silver, non-tarnishing and extremely simple to control.

The Wite-Brass process is said to be very inexpensive to install. A steel tank is used to hold the solution and also serves as anode. The only cost is that of the chemicals for the solution . . . which is less than 20c per gallon. The bath operates at a temperature of 140° to 175°F. at a current density of 25 amperes per square foot. It is stated that after-buffing of plated work is required and that a mirror finish is obtained on polished work when plated for as much as two hours.

In spite of the fact that Wite-Brass is an alloy plate of three metals, it is said that it presents practically no difficulty in control and is easier to maintain than an ordinary brass solution. Wite-Brass deposits at the same rate as an ordinary nickel solution. It can be plated over any metal surface and is recommended for all types of metal novelties, flatwear, optical goods, reflectors, metal stampings, and, in fact, wherever nickel or silver is applied.

## Latest Products

**Each month the new products or services announced by companies in the metal and finishing equipment, supply and allied lines will be given brief mention here. More extended notices may appear later on any or all of these. In the meantime, complete data can be obtained from the companies mentioned.**

**Low Capacity Regulator;** Type HFS, designed for the sensitive regulation of air pressures below 30 pounds. DeVilbiss Co., Toledo, Ohio.

**New Model Bennett Balance,** for weighing up to 100 grams (about 4 ounces). Chemical Publishing Co. of New York, Inc., 148 Lafayette St., New York.

**Explosion Tested Fan Cooled-Motors.** Totally enclosed, direct current. Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

**Horizontal Three-Stage Compressors,** for pressures from 750 to 2,500 pounds. Worthington Pump and Machinery Corp., Harrison, N. J.

**New Line of P&H "Smootharc" Welders.** Single current control with simple manual adjustment; self-excitation an additional feature; stabilized by patented internal winding; other mechanical improvements. The Harnischfeger Corp., Milwaukee, Wisc.

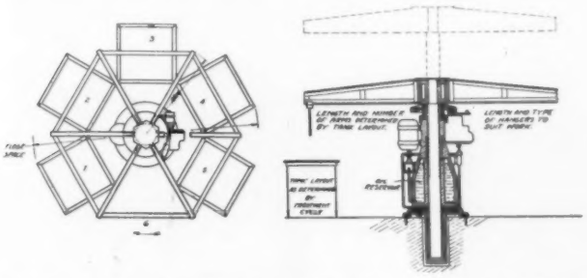
**Extra Heavy Duty Condenser;** Type HP-504-2. For removing oil and water which finds its way into the air line. DeVilbiss Co., Toledo, Ohio.

**New Low Range Direct Current Arc Welder,** utilizing rectifier bulbs instead of rotating equipment. General Electric Co., Schenectady, N. Y.

**Tanner Tank Air Line Anti-Freeze System,** to eliminate air line and air tool freezing; recently improved. System said to be harmless, odorless and non-explosive, not injure metal, hose or lubrication. Sullivan Machinery Company, Michigan City, Indiana.

## Full Automatic Station Type Descaling Machine

A full automatic station type descaling machine has been designed by the Bullard Company, Bridgeport, Conn., for the automatic descaling and degreasing under their Bullard-Dunn process. By this process, (which has been described in previous issues of **Metal Industry**) it is stated, grease, dirt and scale are removed without etching, pitting or doing any injury to the work.



Automatic Descaling Machine

The machine has a central column with radial arms extending out from it. On each arm, the baskets, racks or hooks are hung, holding the work in process. The tanks hold the various chemicals involved in the descaling, degreasing and cleaning treatment, are located in a circle around the central columns so that the work can be dipped in each tank as required. Automatic control is obtained by an adjustable electrical time switch; manual control is obtainable if desired, however, by the use of push buttons.

The work is hung on the machine at the loading station. The column is then raised, turned, lowered, etc., so that the work moves from the first to the second treatment tank and so on. The second load is placed on the machine and receives treatment in the first tank while the first load is being treated in the second tank and so on until all of the arms on the central column have been loaded. By this time the first load is delivered to the unloading station where it is removed and a fresh load of uncleaned work placed on the machine. The machine has no moving chains or sliding electrical contacts, and is said to be rugged and of high load capacity.

## New Chromium Plating Anode

The Hartzell Mfg. Co. Inc., 319 Grand Ave., Dayton, Ohio, have designed a unique type of anode for use with chromium plating solutions, called the Hartzell Parallel Step Anode. It is distributed by the Crown Rheostat and Supply Co., 1910 Maypole Ave., Chicago, Ill. This anode consists of a copper core with an antimonial lead sheath. The copper core is insulated from lead sheath above and below the solution level. It is made with parallel steps (see illustration) to distribute the current more efficiently. The steps are self-cleansing. The following advantages are given:

Throwing power increased.
Two to three times longer life.
No warping or buckling.
No burning off at solution line.
Equal current distribution throughout on entire length.
Reduced cost.

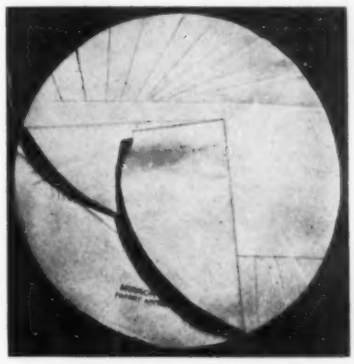
The anodes can be made up with standard hooks or special hooks to suit the special needs of the users and a convenient hand lifting hook is furnished with each order of the hook type anodes.

Hartzell Parallel Step Anode

## Mirror Buff

The Midwest Buff Manufacturing Co., East 79th St. and Platt Ave., Cleveland, Ohio, produces a new type of buffing wheel called the Mirror Buff. It is a 20-ply muslin section buff in which the body is made of cloth strips, arranged fanwise. Eighteen of such pieces together with two full circles, one on each side of the inner strips, form the 20-ply section. The construction of the buff is such that it is thicker at the center than at the periphery. While running, the centrifugal force increases the thickness of the outside edge, making it equal to the thickness at the arbor. This at the same time provides air space, thus automatically cooling the buff.

It is claimed that it is not necessary for the operator to bear down or "lay on" the work. The buff is soft and has considerable drag giving it an action similar to that of a brush, in which the bristles are bent at the point of contact with the work.



**Muslin Buff with Cloth Strips Arranged Fanwise**

One of the advantages claimed for the Mirror Buff is that it does not show buffing streaks of any kind on the work.

## Compensated Belt in Two New Styles

Two new styles of Condor Compensated Belt, known as Style "F" and Style "B," have been developed by the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., of Passaic, N. J. Both have the patented Condor Compensated principle of equalized ply stresses at the arc of contact, but are specially designed for those unusual conditions which require some slip rather than the extremely high coefficient of friction for low-tension operation present in the regular Condor Compensated Belt.

Style "F" has a red friction pulley surface and is designed for use where a slight starting slip is desired, while Style "B" has a bareback untreated duck pulley surface and is built for conditions calling for a greater slip, or where slip

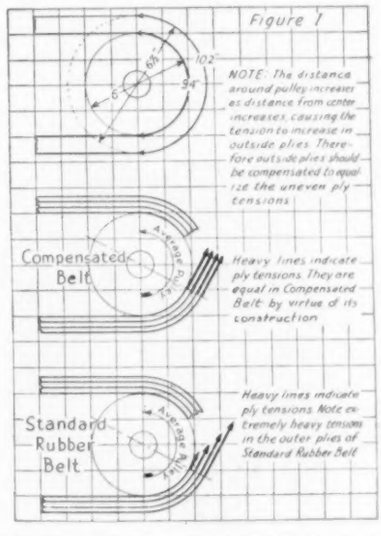



**Diagram of Compensated Belt Action**

is essential, as in the case of Winder Drives.

There are no differences between the construction of these belts and that of the regular Condor Compensated Low-Tension Belt except for the pulley surface.

The Condor Compensated principle of Equalized Ply Stresses consists of building the belt to conform to the pulley curvature thereby relieving the excessive stresses thrown on the outer plies as occurs with standard flat belts and overcoming ply ruptures or separations, broken fasteners and prolonging belt life.

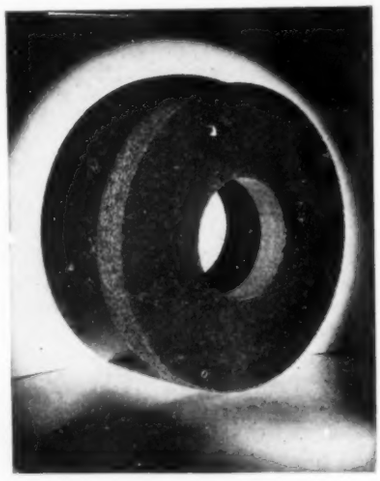
## New Finishing Wheel

Metal finishers will be interested in the new finishing wheel recently developed by the Manhattan Rubber Mfg. Division of Passaic, New Jersey.

This new wheel is said to meet the need for a fine grit wheel with a slight "cushion" effect to follow up grinding operations. Of several types produced, this one has the best combination of clean cutting action and good finish.

Before being announced to the trade, this wheel was placed in a number of selected plants to determine its adaptability for finishing work. It was said to give highly satisfactory results within a wide range of uses as on welds on stainless steel dairy equipment, stainless steel forgings for aircraft, taps and twist drills of both carbon and high speed steels.

Although slightly flexible and having some "give," this wheel is not soft enough to conform to irregular surfaces like cloth polish wheels. It is therefore limited to work having a flat or relatively even curved surface. Its operating speed should not exceed 6,000 surface feet per minute.



Manhattan Finishing Wheel

## New Spray Gun

Plant superintendents and maintenance officials generally, whose problems include repainting equipment and plant interiors and exteriors, will be interested in a low-cost, efficient paint spray outfit including a small air compressor, a spray gun and the necessary hose and nozzle connections.

The new Saylor-Beall spray gun shown here is said to combine both internal and external atomizing nozzles, a feature which makes it available for all various jobs it is called upon to do in industrial plants.

Saylor-Beall Spray Gun

Low pressure internal atomizing is the most economical system for applying most liquids because such nozzles give the greatest coverage per cubic foot of air used. On the other hand some materials, like the new fast drying lacquers, must be atomized after they leave the gun. The Saylor-Beall gun can be quickly changed to handle such materials and results in an all-purpose spray at a minimum investment.

The Saylor-Beall Mfg. Co., Detroit, Michigan, who are introducing this new gun, manufacture a large line of air compressors and accessories, including low-cost outfits especially designed for general maintenance service.

## New Corrosion Resistant Specialties for Use in Plants Handling Corrosive Agents

Two new products designed to meet corrosive problems in a variety of plants where acid, alkali and other corrosive agents are encountered have just been announced by manufacturers. One of these is a Monel caster for trucks, hampers and wheeled conveyors of all kinds. Available in both the stationary and swivel roller type, it is adapted to use in chemical, processing plants, laundries, dry cleaning and similar establishments where the corrosive materials are liable to spill over on the floor.

Metal parts of the caster are entirely of Monel, including bearings, shaft and spacers. Wheels are of a special rubber composition. The casters are manufactured by the Bassick Company, Bridgeport, Conn.

The second piece of equipment is designed for use in similar plants and is a special adaption of an earlier piece of equipment. This is the Whitehead graduated type Monel pail, now made available in standard sizes of 12, 14 and 16 quarts. Its development follows the general acceptance of the non-graduated type of Monel pail which has been on the market for several years.

Whitehead Graduated Type Monel Metal Pail

Bottom and sides are of .037 of an inch Monel electrically seam welded. The chime also seam welded is .078 of an inch thick and is seam welded to project ½ of an inch below the bottom. Monel ears are spot welded to the sides. The handle is 5/16 of an inch Monel rod and the rim is rolled over a 3/16 of an inch wire. The seam cannot break open and there are no rivets at which leaks can start.

## New Low Temperature Brazing Alloy Sizes

The intense interest in low temperature brazing, together with the wide and growing variety of purposes for which silver brazing alloys are being used, have made it necessary for Handy & Harman, 82 Fulton Street, New York, makers of Sil-Fos and Easy-Flo, to add new sizes and forms to their standard price list to more promptly meet the increasing requirements.

Prices of these two alloys have not changed but additions to the standard sizes formerly carried in stock have now been included in a new combined price list covering Sil-Fos and Easy-Flo as well as Handy Flux—the use of which is necessary if full advantage is to be taken of the brazing alloys' low melting points. The new price list became effective Monday, November 2nd.

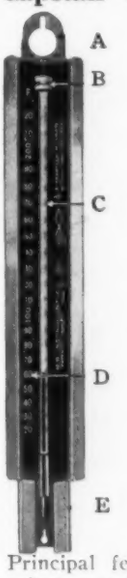
To the former stock sizes of Sil-Fos —used for joining non-ferrous metals— a new strip thickness, 0.005″ has been added in widths of ¼″ or more.

To the wire forms standard with Easy-Flo until now, a new wire size 3/64″ has been added and four new gauges of strip .020″, .010″, .005″ and .003″—¼ or more in width, which should meet practically all requirements.

For special applications, additional forms and sizes including washers, circles, rings and filed or powdered forms are still available and prices can be obtained on application.

Distributing and servicing facilities have been arranged throughout this country and Canada. Standard sizes can be obtained promptly from Handy & Harman with plants in New York, Bridgeport, Providence and Toronto, Canada, and from distributors located in all the principal industrial centers in the country.

## Capstan Head Thermometer




A new type of thermometer has been designed by the H-B Instrument Co. Inc., 2518 N. Broad St., Philadelphia, Pa., called the "Capstan Head." Special features of this thermometer are as shown by the illustration.

Case is one-piece solid copper or aluminum-finished steel, including fingerhold A and bulb-guard E, which are usually soldered on the stamped back. Patented "Capstan Head" B holds lens-front tube in proper relation to auxiliary metal scale D so securely as to prevent slippage. This scale is etched on the metal of the frame. Principal features, however, is that a primary scale C is etched on the lens-front tubing itself, permitting precise readings in addition to the easy readings afforded by auxiliary scale D.

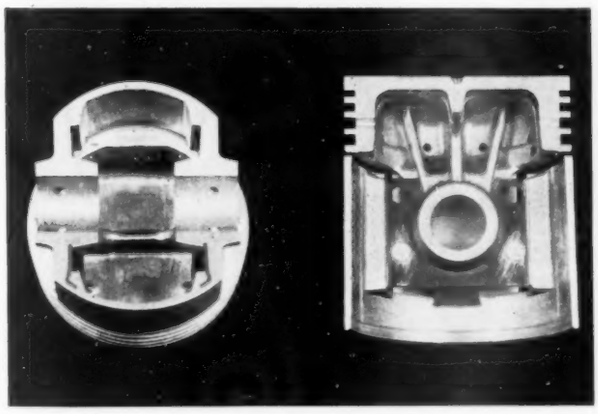
## Magnesium Alloy Goggles

Dowmetal, an alloy composed almost entirely of magnesium is the material used for the Dockson feather-weight goggles made by the C. H. Dockson Company, 2885 E. Grand Blvd., Detroit, Mich. The outstanding feature of these goggles is, of course, their light weight, 36% less than aluminum. Other features presented include individual right and left eye cups designed to fit all faces, simple nose bridge adjustment, eye visibility, ventilation and high resistance to corrosion.

Dockson Featherweight Goggles

## Bohn Autothermic Aluminum Piston

Thermostatic control of expansion is used in the new aluminum alloy piston just announced by the Bohn Aluminum and Brass Corporation, Detroit, Mich., and its piston associate A. L. Nelson. anchored in the aluminum of the skirt, but not to the piston pin bosses, as the skirt, bosses and head compose a one-piece casting, which relieves the steel inserts of thrust and inertia loads.



Nelson Bohnalite piston, Autothermic Type, sawn to show cross section. This is the tin-plated unit used on the new Packard Six just announced

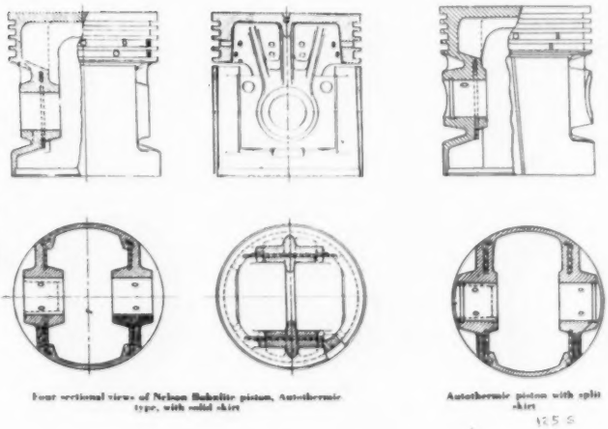
The new unit which is known as the Nelson Bohnalite piston, Autothermic Type, is standard equipment on a number of cars in current production and will appear on more during the 1937 season.

The new piston is said to meet the problem of compensating for the difference in the heat-expansion coefficients of the cast iron cylinder and the aluminum alloy piston in a novel manner. The new Autothermic piston has steel inserts or plates similar in shape to the Invar struts used in a former Nelson design. These inserts are punched and formed from low-carbon steel and set into the mold in such a way that their ends are

In the completed piston these steel strips are paralleled by aluminum over their entire length and these parallel members of steel and aluminum form a thermostatic element from which is derived the name Autothermic. Since the aluminum when heated expands more than the steel, the element will assume a curved form, tending to increase the expansion of the skirt in the direction parallel to the piston-pin and to reduce the expansion along diameters perpendicular to the piston-pin. This effect of the thermostatic elements can be varied by changing the proportions of the cross sections of the steel or the aluminum.

These expansion characteristics cause a piston skirt which is of cylindrical form at working temperature in the engine to assume an oval shape at room temperature. Therefore, in manufacture, the skirt at room temperature is ground oval, and as the piston heats up

Cross section through the latest Nelson Bohnalite piston, Autothermic Type, which has thermostatically controlled expansion



Four sectional views of Nelson Bohnalite piston, Autothermic type, with solid skirt

Autothermic piston with split skirt

in service the autothermic action causes the skirt to approach cylindrical shape without pressure from the cylinder wall, thus maintaining a close working clearance without undue friction. The degree of closeness of the working fit can be varied to suit conditions by properly proportioning the thermostatic elements. Thus the piston can be adapted exactly to the characteristics of any engine to secure maximum piston efficiency.

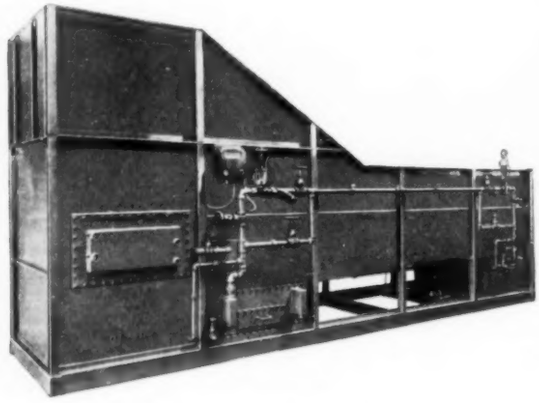
An important advantage claimed for the Autothermic piston is that it eliminates piston-skirt collapse.

From a weight standpoint the Autothermic piston is on a par with the all-aluminum type. A typical 3¼ in. diameter piston, for example, weighs 13.75 ounces and a 3¾ in. heavy-duty truck piston weighs 26.1 ounces.

To prevent cold-scoring of the pistons, they are tin-plated. Plating is accomplished by the immersion process, no current being used.

## Special Vapor-Spray-Vapor Detrex Degreaser

The line of degreasers manufactured by Detroit Rex Products Company, 13005 Hillview Ave., Detroit, Mich., has been augmented by the new machine shown below. This is a special Vapor-Spray-Vapor machine equipped with a monorail conveyor. The unit shown has been designed to handle small racked parts such as poppet valves, flat sheets, etc. Hangers are spaced at intervals along this conveyor to carry the work holding racks.



Detroit Vapor-Spray-Vapor Degreaser

The conveyor is so arranged that the work is lowered into the solvent vapors and passes through pressure sprays of hot clean solvent. After making a horizontal turn around a traction wheel (at the right end of the machine), the conveyor brings the work back through the vapors. Continuing on, the work is elevated, and passes out of the machine at the same end, and at the same elevation as it went in.

Steam coils are placed in the boiling sump (which is shown in the lower left center of Fig. 1) and in the clean solvent distillate collecting chamber (shown at right end of machine). This machine is equipped with an air actuated, steam operated thermostatic control. The boiling sump is equipped with an auxiliary clean-out door to obviate the necessity of removing the steam coils when cleaning out accumulated sludge.

The large header shown at the left of the photograph is a tube-type condenser to augment the supply of clean solvent distillate provided by the water-jacket condenser. A solvent collecting trough is located beneath the water-jacket condenser. All of the distillate flows into the heating chamber at the right end of the degreaser. From here, it is force-pumped directly on to the work. The solvent that drains from the work, as well as the over-flow from the clean solvent heating compartment, flows back into the boiling sump.

For maximum heat economy, this machine is insulated with panelled mineral wool up to the water jacket condenser.

The rated production cleaning capacity of this machine is approximately 6500 small parts per hour at a conveyor speed of 10½ ft. per minute. The over-all dimensions of the unit shown are: 20 ft. long, 5 ft. wide, and 9 ft. high.

## Household Cleaner

Charles H. Proctor, nationally known to the electroplating and metal finishing industries, is interested in the Proctor and Bond Chemical Co., Clearwater, Fla., who are the manufacturers of "Klean-Rite" Cleaner, a packaged material for use in the home. It is recommended for use in the kitchen, for washing clothes, for removing grease and dirt from the hands, and for general household purposes.

## Etching Machine

The Rotospray etching machine made by the U. S. Stoneware Co., Akron, Ohio, is built primarily for the production of photo-engravings, such as halftones, zinc etchings, etc., but its use may also be indicated in other lines in which etched plates are an important part. One of its outstanding qualities is its speed. A zinc plate can be etched in about 15 seconds and a copper halftone in about 50 seconds. Speed control is obtained from the Reeves variable speed drive. A flexlock rubber joint holds the drain spigot in place.

A complete description of this machine is included in Bulletin No. 602, obtainable from the manufacturers.

## Hood Respirator

Announcement is made by The DeVilbiss Company, Toledo, Ohio, of the development of a new Hood Respirator especially designed for use in those occupations where there is a fume or dust hazard beyond the protection offered by the more common type of respirator. This new respirator, the type MPH covers the head and neck fully, and provides complete protection where ventilation is inadequate or against materials present in the air harmful to eyes, ears, or respiratory organs.

Air flows into the hood through an efficient filter, diffuses throughout, and, flowing out through the opening provided for vision, prevents outside atmosphere from approaching the eyes or entering the hood. Thus clear vision without glass or other transparent material to become fogged is provided with perfect safety.

The entire unit is composed of a light-weight headgear, air filter and air hose

DeVilbiss Hood Respirators

which is connected to the air line with a special DeVilbiss quick detachable connection, and a light-weight sanitary flame proofed hood which is supported by the headgear. This hood is fastened around the neck by a draw string. The hood is inexpensive and may be economically removed and replaced by a new one when it becomes soiled.

The new respirator is recommended for use in atmospheres containing offensive chemicals, nauseating vapors, particles of lint, paint spray, dirt or dust. Offering adequate protection against such conditions, it permits maximum comfort and complete freedom of movement without binding or restricting the operator in any way.

Complete information on the new Hood Respirator, type MPH, may be secured from The DeVilbiss Company, Toledo, Ohio.

## New Safety Goggle

American Optical Company, Southbridge, Mass., announces another addition to its line of eye protection equipment—the F-3105 Ful-Vue Goggle. plate Lenses—plus side shields that provide extra protection against particles striking from any direction.

The wire mesh screens are non-corrosive and easily cleaned. The mesh is sufficiently fine to prevent the passage of flying particles but does not hinder air circulation.

New Ful-Vue Goggle

This equipment, according to the manufacturer has all the comfort and safety features of the regular Ful-Vue Goggle—high-up endpieces, self-adjusting nose pads, 6-Curve Super Armor-

## Electric Sander

A new portable electric sander has been placed on the market by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill., called the Thor U58.

The Thor U58 electric sander is said to be far in advance of hand tools for sanding, grinding, cleaning and prep r-ing automobile bodies for paint jobs. The following points in its construction are stressed by the manufacturer:

Perfect balance and ease of handling.

Armature and spindle run in ball bearings.

Inspection of the motor can be made while the sander is running, by simply removing the two brush covers.

The side handle can be used on either side of the machine, which comes equipped with seven-inch flexible rubber pad and a box of 12 assorted abrasive discs.

Thor U58 Sander

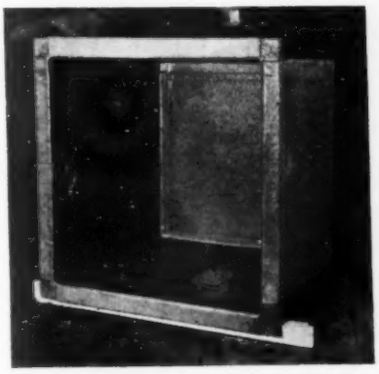
## Koroseal Tank Linings

One of the newest applications for Koroseal, a synthetic rubber-like material developed by The B. F. Goodrich Company, Akron, Ohio, is its use as a lining for tanks handling severe corrosives.

Among Koroseal's outstanding properties is its great resistance to oxidizing solutions which makes it a desirable construction material for lining tanks and other equipment to resist nitric acid, chromic acid and mixtures of nitric and hydrofluoric acids.

Methods of attaching Koroseal to steel, wood and cement have been developed which yield very good adhesion to the base material. Lining cannot be applied to riveted tanks, but welded constructions are very satisfactory. Typical installations of Koroseal lining include steel tanks for handling 67% nitric acid at 130° F. and wood tanks for stainless steel pickling handling a mixture of nitric and hydrofluoric acids. These tanks have been in service for over a year and are still in excellent condition.

Koroseal, being rubber-like in nature, is susceptible to physical damage. It is also thermoplastic and, therefore, is not recommended for service where the actual temperature of liquids in contact with the material exceed 150° F. However, the hazards of physical damage can be eliminated by the application of brick or other protective sheathings over the lining. Where it is desired to use Koroseal in steel vessels at temperatures above 150° F., sheathings of insulating material, such as brick, can be applied over the Koroseal in sufficient thickness to bring the actual contact temperature down to the required minimum.



Koroseal Lined Tank

Repairing of a damaged Koroseal lining is an extremely simple matter. No heat or pressure is required. A few hours' drying time for the Koroseal liquids is all that is required, and the repair is as strong as the original material.

## Flexible Rubber Latex Pail

The Dewey and Almy Chemical Co., Cambridge B, Mass., are manufacturing a new type of pail. It is made in one piece by a patented process from pure liquid virgin latex rubber, designed to give high tensile strength. It is said to have a tensile strength in excess of 4,000 pounds per square inch, and in addition, is reinforced by rubber ribs so that it will hold its full quota of liquid without bulging appreciably.

Flexible Pail

This pail is corrosion resistant to all materials for which rubber can be used. It has the advantages of rubber, namely, that it cannot be dented, cracked or chipped. In addition it is so designed that it can be easily poured when the pail is resting on the edge of a tank without collapsing it and that the pouring rate is controllable from a fine trickle to a generous flow.

## Paper Lacquer

A portfolio which demonstrates the value of paper lacquer for protecting and enhancing the beauty of fine color work is being sent out by Maas & Waldstein Company, lacquer manufacturers, Newark, New Jersey.

The portfolio contains two identical designs in six colors, one of which is just as it came from the press while the other has been treated with a coat of Crystalustre, M & W's new lacquer for paper and cardboard. The manner in which the coating of lacquer intensifies colors is obvious at a glance, and a little experimenting shows that the lacquered surface is proof against ordinary scratching, marring, and smudging, and readily withstands washing.

The use of lacquer on paper and card is a recent development, but it is increasing constantly. Advertisers and package designers are finding that lacquering is desirable for car cards, window cards, displays of various kinds, cartons, labels, wrappers, menus, and other kinds of printed and lithographed art work that should be both beautiful and durable.

Crystalustre, the manufacturer claims, is flexible, colorless, odorless, quick drying, and easily applied. It protects the surface to which it is applied from dirt, discoloration, stains, and the effects of water, soap, grease, oil and fat, and alcoholic beverages, and it will not darken with age, discolor white or light colors, or become soft and tacky.

## Rod Straightener and Shear Machine

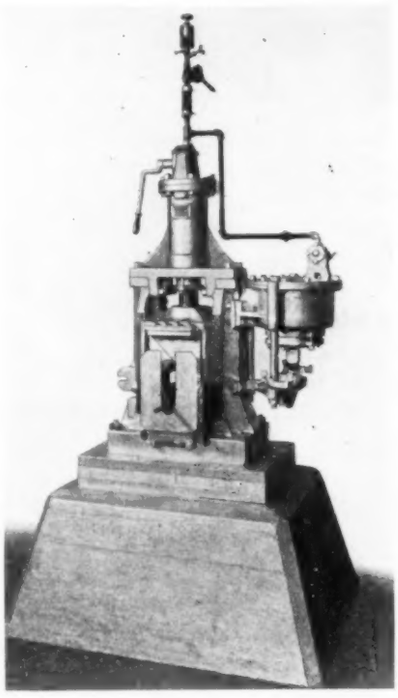
An improved rod straightener and shear machine is announced by The American Foundry Equipment Co., 408 Byrkit St., Mishawaka, Ind.

The American Rod Straightener and Shearer was designed for reclamation of rods, bolts, wire and nails; to reduce scrap piles, save labor and materials and pay profits through salvaged materials which formerly constituted waste. Laborers formerly occupied in straightening rods by hand can be put to more profitable work in other capacities.

Rapidity of operation in both straightening and shearing is said to be limited only by the speed of the operator in feeding stock into the machine. The American Rod Straightener and Shear machine is made in all sizes from a small hand operated model with a maximum straightening capacity of ¼" rods to a large compressed air unit with maximum straightening capacity of 2½" rods.

With the exception of the hand operated model, all of the machines are operated by compressed air, sixty pounds being the minimum pressure for satisfactory operation.

The straightening mechanism is composed of manganese steel dies which close as a contracting square on the rod or bar and deliver an impact on four sides simultaneously. Operation is controlled and the force of the blow is regulated by a hand control lever which actuates the air throttle valve.



American Rod Straightener

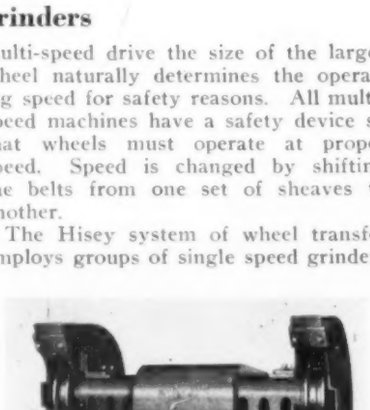
## Snagging Grinders

The Hisey-Wolf Machine Company, Cincinnati, Ohio, have designed a new line of heavy duty texdrive snagging grinders. These are made in four sizes —5, 7½, 10 and 15 HP., and 15 different types consisting of single spindle grinders, multi-speed grinders and two spindle grinders with one or more speeds. There is a size and type for every need.

These machines are designed and proportioned throughout for the most severe duty, with weight distributed to minimize vibration. Wheel guards and mounting brackets are of steel. They have hinged covers and steel chip breakers mounted in box type slide. Guards are adjustable (move back) to the wear of the wheels. Work supports have horizontal and vertical adjustment and are extra heavy.

The two motor—two spindle grinder is said to be the most efficient in that the speed of either spindle can be changed independently to suit size of wheel. On single spindle machines with multi-speed drive the size of the larger wheel naturally determines the operating speed for safety reasons. All multi-speed machines have a safety device so that wheels must operate at proper speed. Speed is changed by shifting the belts from one set of sheaves to another.

The Hisey system of wheel transfer employs groups of single speed grinders arranged in sets for different size wheels. For example: Grinder No. 1 is equipped with 30" wheels and with speed to suit. When a wheel on Grinder No. 1 is worn to 24 inches, it is removed for transfer to Grinder No. 2 which has guards and speed for 24 inch diameter wheels. When a wheel on machine No. 2 is worn to 20 inches, it is again removed for transfer to machine No. 3. In this way all wheels throughout their entire life have operated at their most efficient and economical speed.



Snagging Grinder

## Bright Zinc Deposit

Grasselli Chemical Department of E. I. Dupont de Nemours & Company, Cleveland, Ohio, has just issued a trade bulletin explaining the use of "Zin-O-Lyte," which, it says, is the one process for bright zinc plating producing brilliant deposits direct from the bath without bright dipping. The process, it is stated, operates with equal success in still plating or in barrel plating. The deposits are said to be ductile and firmly adherent. Molybdenum, in small amounts, co-deposited with zinc, produces a brilliant finish without bright dipping, a polished surface direct from the bath.

The Company has developed a process for the control of the corrosion of the zinc anode whereby the anode current efficiency is approximately the same as the cathode current efficiency, making it possible to hold the zinc content within normal limits. This, it is claimed, overcomes the difficulty formerly experienced with the gradually increasing zinc content of the electrolyte because of excessive anode corrosion.

## Rust Inhibitive

R-700 Rust Inhibitive is made and sold by the Varnish Products Co., 5208 Harvard Ave., Cleveland, Ohio. This material is not a varnish or a lacquer. It is said to be a combination of synthetic materials, with the following properties:

1. Maximum resistance to rust.
2. Quick-drying time.
3. Tenacious adhesion to all metals.
4. Suitability as a permanent priming coat under other finishes.
5. Leafing and suspending powers for bronze powders.
6. Clarity and lightness of color.

Toluol or Xylol are best suited as thinners although for special work, benzol can be used where this material is prohibited.

## New Flux

"Puralit" is a flux composition for melting, purifying, degasifying and deoxidizing aluminum and light metal alloys. It has been actually employed in practice by leading aluminum foundries in Europe since 1929 and the inventor has been honored with the Diploma of Merit at the International Foundry Exposition held at Milan.

Italy, in September, 1931. Exclusive distributors in United States and Canada are Adolphe Hurst & Co., Inc., 330 W. 42nd St., New York.

Having a low melting point, the material starts its activities early thus, it is stated, preventing oxidation during the melting process. Impurities are effectively dissolved and forced to the top for safe removal. "Puralit" forms on the surface a layer of ashes. This layer separates cleanly from the metal reducing metal loss on skimming to a minimum.

"Puralit," it is claimed, does not develop injurious or poisonous gases or vapors; it can safely be used for fluxing light alloys without harmfully affecting the composition of the alloy metal or its mechanical properties.

## Acid-Resisting Floors

Acid-Resisting hot asphalt mastic flooring has been successfully used by plating concerns for a number of years. It affords complete protection where commercial acid and alkali conditions are encountered. It is waterproof and can readily be cleaned by flushing with water. This type of flooring can be laid over any good solid foundation of concrete or wood, new or old, and can be used the day following installation. For over a quarter of a century, Gorman & Lees, Inc., 344 West 24th Street, New York, N. Y. have been installing these floors and maintain a complete service to meet the individual's flooring needs. Full information can be obtained without obligation.

## Bath Salts for Non-Ferrous Metals

Holden Anneal No. 975 is a bath salt made by A. F. Holden Co., New Haven, Conn., with a melting point of 925° to 950° F. with a useful range of from 1050° to 1500° F. It is of the chloride carbonate variety, maintaining a balance between the carbonates and chlorides.

The material, as manufactured, is stable in its chemistry provided it is not heated beyond the fuming point which is 1550° F., at which point some of the carbonates are released and a slight change in melting point might occur.

This particular bath, the same as other baths of this type, has the distinction of not producing any oxide on the work as it maintains an unbroken seal during transfer from the bath to a water quench which is used on all non-ferrous metals.

It is said, however, to have a unique characteristic of its own in that Sterling Silver, which may have oxide on its surface, when being annealed in Holden Anneal No. 975, has this oxide removed without any loss in weight of the metal. This, it is claimed, is a distinction peculiar only to this particular composition; also that it seems to produce a brighter anneal than is common with other baths of this general type.

This particular product is being used on brass, copper and copper nickel alloys as well as Sterling Silver.

## Modern Crystal Lacquer

An unusually attractive finish for metal, glass, wood, fibre, paper, composition, metal foil etc. has just been placed on the market by the H. V. Walker Co. of Elizabeth, New Jersey.

This new finish is known as Modern Crystal Lacquer. It is sprayed on the object to be finished, and strikingly beautiful effects are secured by the artisan. All sorts of fantastic crystal-like forms are produced in kaleidoscopic patterns—no two forms being exactly alike, regardless of the area to be covered.

One of the valuable features claimed for this Walker product is that it may be had in crystal clear or in colors. This indicates the wide variety of uses to which this type of finish may be employed.

**Modern Crystal Lacquer**

The H. V. Walker Co. will be glad to send samples and full details to inquirers.

# New Catalogs

**Haynes Stellite Burnishing Rollers.** Haynes Stellite Co., Kokomo, Ind.

**Supplement to a Visual Report of Progress in Zinc Alloy Die Castings.** A collection of illustrations of some of the new types of die castings now being made of zinc base alloys. New Jersey Zinc Co., 160 Front St., N. Y.

**Zinc Metals and Alloys.** Technical data, properties, etc., concerning all of the metal products of the New Jersey Zinc Co. except rolled zinc. Included are: preferred grades of slab zinc for galvanizing; slab zinc for brass and other alloys; for the elements of primary wet batteries; for anodes in electroplating; Zamak alloys for die castings. New Jersey Zinc Co., 160 Front St., N. Y.

**"Here's the Answer to Your Temperature Problem."** Brown thermometer controllers. Brown Instrument Co., Philadelphia, Pa.

**Future Markets for Automobiles.** A study of this industry. Young Management Corp., Lincoln Bldg., New York.

**Smootharc Welders and the New Line of P & H Hansen Smootharc Welders.** Bulletin W8. Harnischfeger Corp., Milwaukee, Wisc.

**Explosion Tested Fan Cooled Totally Enclosed Type SK Direct Current Motors.** Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

**Heavy Duty Roll Grinder;** for precision, production in heavy roughing or fine polishing. Bulletin No. 111. Farrel-Birmingham Co. Inc., Ansonia, Conn.

**Handbook on Flow Meter Engineering:** principles, designs, applications and installation. The data covers all types of fluid measuring equipment using orifice. Price $2.00. The Brown Instrument Co., Wayne & Roberts Aves., Philadelphia, Pa.

**Albachrome.** A new process for chromium plating. Albachrome Corp., 40-35-21st St., L. I. City, N. Y.

**Certified Steel Abrasives;** for all blast cleaning work. Pangborn Corp., Hagerstown, Md.

**High Temperature Electric Furnaces.** Metalectric Furnaces, Ltd., Cornwall Rd., Smethwick, Birmingham, England.

**Portable Electric Furnaces.** Metalectric Furnaces, Ltd., Cornwall Rd., Smethwick, Birmingham, England.

**Temperature Indicating & Recording Equipment.** Metalectric Furnaces Ltd., Cornwall Rd., Smethwick, Birmingham, England.

**The Story of Indirect Lighting in Business.** Silvray Lighting Inc., 755 General Motors Bldg., N. Y. C.

**Dupont Duprene.** A story of man-made rubber. E. I. duPont de Nemours & Co., Wilmington, Dela.

**Safco Core Oils.** F. J. Low Co., Inc., 16 W. 46th St., N. Y. C.

**Flexement for Polishing Work on All Metals.** J. J. Siefen Co., Detroit, Mich.

**Thermometers and Pressure Gauges, Indicating, Recording and Controlling.** Catalog No. 6703. Brown Instrument Co., division of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

**Smootharc Automatic Welding Head.** Bulletin W9. Harnischfeger Corp., Milwaukee, Wisc.

**High Duty Magnetic Separators;** type K Bulletin No. 700. Stearns Magnetic Mfg. Co., Milwaukee, Wisc.

**Norton Abrasives for the Lapidary.** Norton Co., Worcester, Mass.

**Photo-Electric Cells and Apparatus.** Developed by Dr. Bruno Lange. Pfaltz and Bauer, Inc., Empire State Bldg., New York.

# Associations and Societies

## American Electro-Platers' Society

### Annual Convention in New York

The Annual Convention of the American Electro-Platers' Society in 1937 will be held on June 14, 15, 16 and 17 and will celebrate the Silver Jubilee of the organization. The Convention Headquarters will be at the Hotel Pennsylvania opposite the Pennsylvania Railroad Station in the very heart of Manhattan. It is ideal from the point of view of location in the midst of city activity, space, comfort and luxury, and at the same time it offers splendid accommodations for convention purposes. It is the plan of the New York Branch to make the members' visit and stay in New York joyous, profitable and stimulating; a long remembered happy episode.

### Exhibit of Plated Work

A special innovation is being arranged —an outstanding exhibit of plated ware to be submitted by manufacturers and members of the various branches.

### Practical Papers

A special educational program is being planned. One entire day is to be devoted to the reading of practical papers submitted by plating room foremen. This is in addition to a most interesting and comprehensive, technical and scientific program. To this end the Chairman of the Educational Committee has already had assurance of wholehearted response from the rank and file of the membership.

The Convention Committee seeks the co-operation of all members of the Society and others interested in the success of the Convention. The following is a list of the different chairmen who will welcome constructive suggestions.

**General Chairman and Treasurer: F. J. MacStoker,** 25 Princeton St., Garden City, N. Y.

**Secretary: H. A. Painter,** Berkley Blvd., Iselin, N. J.

**Publicity: L. H. Cates,** Enequist Chemical Co. Inc., 255 Freeman St., Brooklyn, N. Y.

**General Program: R. J. Ligouri,** 2429 Hubbard St., Brooklyn, N. Y.

**Hotels and Reservations: Aaron Englander,** 729 Lafayette Ave., Brooklyn, N. Y.

**Educational: John Rolff,** 117-30 168th St., Jamaica, N. Y.

**Entertainment and Banquet: B. Popper,** c/o Egyptian Lacquer Co., Rockefeller Center, N. Y.

**Registration: H. A. Painter,** Berkley Blvd., Iselin, N. J.

**Transportation: H. Levine,** 371 Fort Washington Ave., N. Y.

## Electrochemical Society

### Columbia University, New York

The spring meeting of the Electrochemical Society will be held in Philadelphia, April 28-May 1, 1937. A session on electrodeposition is being planned and two papers are alrady in print:

The Eectrodeposition of Manganese from Aqueous Solutions by W. E. Bradt and H. H. Oaks.

Heavy Nickel and Chromium Deposition in England by Charles F. Conilla.

## Brass Forging Association

### Care of G. F. R. Wheat, Secretary, Revere Copper & Brass, Inc., Rome, N. Y.

At a meeting of the members of the brass forging industry of the country, held in New York, delegates representing practically the entire industry formed a national organization, The Brass Forging Association. A complete constitution and by-laws were adopted, and the following directors were elected:

**H. B. Harvey,** president, Harvey Metal Corp., Chicago, Ill.; **F. L. Riggin,** president, Mueller Brass Co., Port Huron, Mich.; **G. F. R. Wheat,** assistant sales manager of Revere Copper & Brass, Inc., Rome, N. Y.; **Otto Von Au,** Accurate Brass Co., Brooklyn, N. Y.; **E. S. Wayland,** vice-president, American Brass Co., Waterbury, Conn.; **T. W. Kuhn,** assistant to president, Bohn Aluminum & Brass Corp., Detroit, Mich.; **F. S. Hyde,** Scovill Mfg. Co., Waterbury, Conn., and **E. R. Chase,** assistant sales manager of Chase Brass & Copper Co., Waterbury, Conn.

The officers elected are as follows: **H. B. Harvey,** president; **T. W. Kuhn,** vice-president; **G. F. R. Wheat,** secretary; **F. L. Riggin,** treasurer.

## Connecticut Non-Ferrous Foundrymen's Association

### c/o L. G. Tarantino, 565 W. Taft Ave., Bridgeport, Conn.

The regular meeting of the Connecticut Foundrymen's Association was held on Tuesday, November 17th, at the Hotel Duncan in New Haven, Conn. **T. Joseph Judge** of Jenkins Bros. Co. of Bridgeport, presided. The subject under discussion was the Computation of Metal Mixtures led by **D. Tamor,** metallurgist, Reading, Pratt and Cady Co., Hartford, and **Harold King,** metallurgist, Jenkins Bros. Co., Bridgeport, Conn. A round table discussion followed on a number of special foundry problems. The meeting was well attended and thoroughly enjoyed.

**F. B. Diana,** chairman of the program committee announced that the next meeting would be held December 15th at the same place. It will be addressed by **H. W. Dietert** of the Harry W. Dietert Co., Detroit, Mich., on the subject of Sand Control.

## American Society for Testing Materials

### 260 S. Broad St., Philadelphia, Pa.

The Twentieth Anniversary of the American Society for Testing Materials atmospheric corrosion tests on iron and steel sheets, which were exposed at Annapolis, Md., in 1916, was celebrated on Friday, October 16th. A banquet was held at Carvel Hall, Annapolis.

One of the features in the series of the original specimens used in the tests was that some of the samples contained added copper and a comparable number were non-copper-bearing or had low-copper content. The experiments demonstrated quite conclusively that steel sheets containing up to about two-tenths per cent copper offer a distinct increase to resistance to atmospheric corrosion as compared with sheets with little or no copper when they are both exposed freely to the atmosphere.

In another program 550 specimens of zinc-coated iron and steel sheets were exposed at each of five committee test sites, to various types of atmosphere and in an extremely extensive test investigation begun in January, 1929, 700 hardware specimens carrying commercial metal protective coatings of zinc applied by various processes,—cadmium, aluminum, lead, etc.,—have been exposed at each of the five test locations.

## National Battery Manufacturers Association

### 7 East 44th St., N. Y.

The twelfth annual convention of the National Battery Manufacturers Association was held at the Sherman Hotel in Chicago, Oct. 15 and 16, 1936.

The following officers and directors were elected for the ensuing year:

President — **L. B. F. Raycroft,** The Electric Storage Battery Co., Philadelphia, Pa.

First vice-president — **L. N. Talkes,** Cleveland Storage Battery Co., Cleveland, Ohio.

Second vice-president—**R. T. Pierson,** USL Battery Corp., Niagara Falls, N. Y.

Secretary—**E. T. Foote,** Globe-Union, Inc., Milwaukee, Wisc.

Treasurer—**L. A. Doughty,** Carlile & Doughty, Inc., Conshohocken, Pa.

Directors—**W. A. Baker,** Firestone Steel Products Co., Akron, Ohio; **G. W. Douglas,** Douglas Battery Mfg. Co., Winston-Salem, N. C.; **F. C. Kroeger,** Delco-Remy Corp., Anderson, Ind.; **B. F. Morris,** Emark Battery Div. Thomas A. Edison, Inc., Kearney, N. J.; **R. D. Mowry,** Universal Battery Co., Chicago, Ill.; **S. W. Rolph,** Willard Storage Battery Co., Cleveland, Ohio.

## American Zinc Institute

### 60 E. 42nd St., New York

The first meeting of the Galvanizers Committee under the sponsorship of the American Zinc Institute was held at Pittsburgh, Pa., November 18 and 19. A two-day program included morning and afternoon sessions on both days and

the discussions covered technical and operating problems in the galvanizing department with special reference to the galvanizing of sheets. Plans were also presented for the formation of permanent organization of this group.

The chairman of the Organizing Committee is **F. G. White** of the Granite City Steel Co., Granite City, Ill.; secretary, **E. V. Gent,** secretary of the American Zinc Institute.

## The Wire Association

**17 E. 42nd St., New York**

The activities of this association have grown so that it has become necessary to organize it into two divisions.

(1) Non-Ferrous Division.

(2) The Cold Working and Cold Finishing of Metals Division.

Both of these divisions will be organized along the line of a clearing house for ideas on manufacturing problems, technical problems and research work in all phases of practical production. Publication of articles or research papers will be carried on through the official publication, Wire and Wire Products, and the Wire Association will carry on an information service for the exchange of questions, answers among its members.

At the National Wire Association meeting, there will be three sessions: one devoted to metallurgy and research; one devoted to forming and fabricating products, and one devoted to processes, and machines of production.

The activities of the Non-Ferrous Division of the Wire Association do not in any way coincide or conflict with the activities of the National Electrical Manufacturers Association.

## Electrodepositors' Technical Society

**Headquarters, Northampton Polytechnic Institute, St. John St., London, E. C. 1, England**

The Electrodepositors' Technical Society is undertaking the promotion of an International Conference on Electrodeposition in London, March 3rd and 4th, 1937. Representatives will be brought together from Germany, Italy, Japan, Norway, Belgium, the United States and other countries. It is the intention to stress at this Conference, the commercial applications of electrodeposition in all its aspects. A provisional program is as follows:

**Wednesday, 3rd March**

Opening Ceremony at British Industries House, followed by Luncheon.
First Session (afternoon):
"Electrodeposition Practice Abroad."
Second Session (evening):
"Electrodeposition of Base Metals."

**Thursday, 4th March**

Third Session (morning):
"The Properties of Electrodeposits."
Fourth Session (afternoon):
"Electrodeposition of Precious Metals."
Reception and Dinner.

Papers have been accepted from Belgium, Czechoslovakia, France, Germany, Holland, Russia, Switzerland and the United States. George B. Hogaboom is Chairman of the Papers Committee for the U. S.

## International Association for Testing Materials

**28 Victoria St., London, S. W. 1, England**

The second International Congress will be held April 19-24, 1937. The proceedings will be based on selected papers, which have been contributed by leading authorities in the principal countries throughout the world. Approximately 150 papers are already promised.

One of the sessions will be devoted to metals, during which the papers will be grouped in the following classes:

(1) Behavior of Metals (mechanical and chemical) as dependent upon temperature, particularly in regard to high temperatures.

(2) Progress of Metallography.

(3) Light Metals and Their Alloys.

(4) Wear and Machinability.

## American Oil Burner Association

**30 Rockefeller Plaza, New York**

The National Oil Burner and Air Conditioning Exposition and Convention will be held March 15 to 19th at the Convention Hall of the Commercial Museum, Philadelphia, Pa. Among the exhibitors expected to participate are manufacturers of domestic, commercial and industrial oil burners, distillate burners and air conditioning equipment for heating, cooking and power purposes. Numerous operating exhibits will be included. A number of technical sessions will be held.

Thirty-nine manufacturers have already indicated that they will participate in the Show.

## Engineering Foundation

**29 W. 39th St., New York City**

The Engineering Foundation announces the election of the following officers and committee men:

Chairman, **F. M. Farmer,** vice-president and chief engineer of the Electrical Testing Laboratories, New York; vice-chairman, **D. Robert Yarnall** of the Yarnall - Waring Co., Philadelphia; Executive Committee; **Otis E. Hovey,** 71 Broadway, New York; **A. L. J. Queneau,** metallurgist of the United States Steel Corp., New York; **Prof. Walter I. Slichter** of Columbia University, New York.

A Research Procedure Committee was chosen including representatives of the various engineering societies. Among them is **Sam Tour,** consulting metallurgist, 47 Fulton St., New York, representing the American Institute of Mining and Metallurgical Engineers.

Additional members of the Research Committee will be designated to represent various industries including nonferrous metals.

## Purchasing Agents Association of New York

**120 Broadway, New York**

The Purchasing Agents Association of New York will conduct their 4th Annual Exhibit of Members' Products at the Hotel Pennsylvania, New York, November 17th and 18th. Seventy-five members will have their displays on exhibit and metals will be among the industries represented.

# Personals

## Harold K. Work

Harold K. Work has been appointed manager of Research and Development of the Jones and Laughlin Steel Corporation, Pittsburgh.

Before coming to Jones & Laughlin, Dr. Work was with the Aluminum Company of America, having started in their research department in 1929 at their Buffalo, N. Y. plant. In 1931 he was made head of the Electrochemical Division of the Aluminum Research Laboratories at New Kensington and in 1934, Chemical Engineer of the Jobbing Division.

Dr. Work was graduated from Columbia University in 1923 with his Batchelor of Arts degree and in 1925 received his degree in Chemical Engineering. He then came to the Mellon Institute of Industrial Research of the University

DR. HAROLD K. WORK

of Pittsburgh where in 1929 he was awarded his Ph.D. degree. The author of several technical papers on chemistry and electroplating, Dr. Work is a member of the American Chemical Society, the Electrochemical Society and the American Electro-Platers' Society.

**Frank G. Breyer** of the firm of Singmaster and Breyer, 420 Lexington Ave., New York, has been elected president of the Association of Consulting Chemists and Chemical Engineers. Mr. Breyer, who was associated for seventeen years with the New Jersey Zinc Company, is a specialist in the metallurgy of zinc, the manufacture of pigments, paint, rubber, plastics, lacquers and the utilization of low grade fuel.

**Frederick Salditt** has been appointed vice-president of the Harnischfeger Corporation of Milwaukee, Wisc. Mr. Salditt has been with the Harnischfeger Corporation for over thirteen years.

**Leon Smith** has been appointed resident sales representative to cover the state of Maine for the Magnus Chemical Co., Garwood, N. J., manufacturers of cleaning materials, industrial soaps, sulfonated oils, emulsifying agents and metal working lubricants.

**Arthur Eckhardt** who formerly represented the Magnus Chemical Co. in the states of Iowa and Illinois, has been appointed to represent Magnus Products in Texas.

**Franklin R. Hoadley, Farrel-Birmingham Co., Inc.,** Ansonia, Conn. was elected president of the **National Founders Association** to succeed **Thomas W. Pangborn, Pangborn Corp.,** Hagerstown, Md. **Mr. Pangborn** was elected **an Honorary Member.**

**William Rowe,** formerly chief engineer for the American Blower Corporation, has joined the staff of the Trane Company, La Crosse, Wisc. Mr. Rowe will take charge of fan engineering.

**Prof. Elihu Thomson,** inventor of the resistance welding process and one of America's pioneers in the field of electrical science, was honored on Oct. 16 when the Detroit section of the American Welding Society dedicated its program to the fiftieth anniversary of his invention of the resistance welding process. The basic patent on this process was granted in 1886. Because of his advanced age, 84 years, Prof. Thomson was unable to be present.

**Theodore H. Pickering** has been appointed general manager of the Batavia, N. Y., plant of the **Doehler Die Casting Company,** succeeding the late **Chas. I. Hodgson. Mr. Pickering** has for eight years been a member of the Doehler sales organization. His place in that department will be taken by **James Hursch,** of Pottstown, Pa.

**Roy E. Cole** has been appointed vice-president in charge of engineering of the Studebaker Corp., South Bend, **Ind.**

**Chas. W. Hardy,** industrial consultant has been appointed general manager of Mondaine Products Corp., 20 W. 20th Street, New York City. Their plant occupies two floors of this building and one floor of the building at 35 W. 19th Street. They employ about 250 people, manufacturing a line of fancy popular-priced compact cases, make-up boxes, cigarette cases, combination compacts and cigarette cases, vanity mirrors, etc. They also manufacture a number of their own cosmetics.

**John C. Bryan** has taken a position with Foster D. Snell, Inc., 305 Washington Street, Brooklyn, N. Y.

# Obituaries

## William S. Rowland

William Samuel Rowland, president of The Stanley Chemical Company, East Berlin, Conn., died suddenly on November 12th while visiting friends in Great Barrington, Mass.

Mr. Rowland has been prominent in the industrial and social life of New Britain, where for many years he has made his home.

Born in Baltimore, Md., in 1881, the

WILLIAM S. ROWLAND

son of William and Ernestine Rowland, he attended Cornell University, graduating with the Class of 1907 with an A.B. degree. Upon leaving college, Mr. Rowland entered the employ of Arthur D. Little, Inc., as a chemist and upon concluding an assignment with the Stanley Works of New Britain, Conn., entered their employ.

During his engagement by the Stanley Works, Mr. Rowland was instrumental in the development of many valuable processes relating to japan, lacquer and synthetic coating which ultimately led to the establishment of a subsidiary manufacturing organization under his leadership.

In addition to his activities with the Stanley Chemical Company, Mr. Rowland was a Director of the New Britain Machine Company, Rogers Sash and Door Co., Rockliffe Bros. Co., Naugatuck Lumber Co., Swift & Upsom Co., Evans, Nye & Harmon, Inc., and a Trustee of Shuttle Meadow School.

During the world war Mr. Rowland served in the Chemical Warfare Service with a commission of Major, assigned to the Development Division. He was married to Helen Rockwell Platt of New Britain in 1915, who with two sons and two daughters survive.

## John F. Harman

John Frelinghuysen Harman, known in New York City as the "Dean" of the silver trade, died at his home, 505 West 8th Street, Plainfield, N. J. on November 25, 1936 in his ninety-third year. At the time of his death he was a member of the Board of Directors of Handy & Harman, the internationally known precious metal house established in 1867, but he had relinquished his executive duties five years earlier on May 1st, 1931, the anniversary of his 87th birthday.

An extended biography will appear in an early issue of **Metal Industry.**

## William Bergfels

William Bergfels, founder of William Bergfels & Co., **metal spinners,** died November 17, at his home, 20 Camp St., Newark, N. J., after a long illness. He was formerly connected with the Newark Nickel Plating Co.

Mr. Bergfels was born in Lyons Farms section of Newark, Nov. 13, 1867, a son of the late Rev. William H. and Electra Jane Sayres Bergfels. Mr. Bergfels also had lived in Asbury and Belleville. He was a member of Kane Lodge, F & A M and the Masonic Veterans.

## Harry Flint Huff

Harry Flint Huff, manager of the extruded metals and die press department of the American Brass Co. at Kenosha, Wis., until illness necessitated his retirement a year ago, died on Oct. 24. Mr. Huff was born in Flint, Mich., 46 years ago, and went to Kenosha with his parents when five years old. He entered the employ of the brass concern shortly after being graduated from high school.

## David W. Clark

David W. Clark, managing director of Anglo-Canadian Wire Rope Co., which with the Atlas Metal and Alloy Co. of Canada, Ltd., he founded, died September 23. Mr. Clark was 68 years old.

## Frank L. Goetz

Frank L. Goetz, second vice-president of James H. Rhodes & Company, Long Island City, N. Y., died on Friday, November 6th, at 48 years of age. He had been connected with the company for twenty-six years, starting as a salesman and working his way up steadily to a vice-presidency and a partnership. For the past twenty years, Mr. Goetz had been in charge of the New York office of the company.

Surviving are his widow, a son and daughter.

## Chromium Patent Suit

Suit has been started by Alfred M. Malloy against Dr. D. T. Ewing to restrain him from selling, assigning, transferring or in any other way disposing of patents No. 1,864,013, No. 1,864,041 and No. 1,952,793, relating to a chromium plating process known in the industry as the Ewing process. Mr. Malloy claims that the process was developed by him while he was working under Dr. Ewing at Michigan State College, and that he was defrauded of his rights. Judge De Witt H. Merriam of the Wayne Circuit Court signed a temporary injunction forbidding the assignment or selling of the patents.

Dr. Ewing states that the suit is wholly without warrant and will be vigorously defended.

## National Automobile Show

The National Automobile Show was held at Grand Central Palace, November 11-18, 1936. It was the largest and most enthusiastic show in years.

The condition of the industry is, as everyone knows, decidedly encouraging. Sales of cars in 1936 will approach some of the high records made in pre-depression times; the prospects for 1937 are bright.

Features of the cars as related to nonferrous metals and metal finishing are interesting. Zinc alloy die castings are outstanding for the number of new applications, the increased size of the castings and the increased complexity of the parts for which they are used.

A large proportion of the cars are still using the zinc base die cast grille set before the radiator. Necessarily these grilles are finished in chromium with a sound undercoat of nickel and in some cases, copper. Chrysler models no longer use the grille proper in die cast form, but instead, long die cast louvres. Packard and Cord convertible models use die cast windshield frames, weighing as much as 29 pounds and measuring up to 50" x 22" over all. Other die cast parts throughout the cars include the hub for the steering wheel; brackets for head and tail lamps; horns; shells and brackets for unit heaters; grilles, panels for instrument boards; interior and exterior hardware; radiator ornaments; parts in the new Bendix Weiss universal joint, parts of the carburetor and fuel pumps; windshield wipers, speedometers, window regulators, etc. All of the above die castings are zinc base alloys. While the parts are in most cases small, the total quantities used are so large as to make up very important tonnages of zinc.

Aluminum die castings are used in some cases such as the supports for valve rocker arms, pistons in hydraulic brake cylinders, etc.

No material changes in finishes are outstanding. Exposed parts are plated with nickel and chromium. Unexposed zinc base die castings are generally left bare, but in some cases are finished by the Cronak process by dipping in dichromate solution to increase corrosion resistance.

# Corporation Earnings

| Net Profit Unless Followed by (L) Which is Loss | 1936 | 1935 |
|---|---|---|
| Anaconda Copper Mining Co. (9 mos. ended Sept. 30) | $9,940,132.00 | $7,856,153.00 |
| International Nickel Co. of Canada, Ltd. (9 mos.) | 27,029,079.85 | 18,080,827.01 |
| New Jersey Zinc Co., (9 mos.) | 3,593,585.00 | 3,342,216.00 |
| Vulcan Detinning Co. (9 mos.) | 205,170.00 | 217,972.00 |

# Business Items-Verified

**O-Pan-Top Mfg. Co.,** 250 South St., Newark, N. J., manufacturer of hand carpet sweepers and parts, has leased building at N. J. R. R. Ave and Vanderpool Sts., about 50,000 sq. ft. floor space, for expansion. Present works will be removed to new location early in January and additional machinery installed. This firm operates the following departments: tool room, stamping, metal spraying, lacquering and enameling.

**Sunbeam Electric Mfg. Co.,** Evansville, Ind., has let general contract for a one and two-story addition, 135 x 180 feet, to cost close to $100,000 with equipment. The company manufactures steam driven turbo-generator and headlights for locomotives and electric refrigerator units. The new construction is a plant for refrigerator cabinets. The following departments are operated: tool room, casting shop, cutting-up shop, stamping, tinning, brazing, plating, grinding room and lacquering.

**Leonard Refrigerator Co.,** Grand Rapids, Mich., has let general contract for a one-story addition and improvement in present plant, at a cost of over $60,000 with equipment. The company which manufactures electric refrigerators, cabinets, etc., is a subsidiary of Kelvinator Corp., Detroit. The following departments are operated: tool room, stamping, soldering, tinning, grinding, polishing and buffing, enameling.

**Latrobe Electric Steel Company,** 40 W. 40th St., New York, announces that the **International Nickel Company,** 67 Wall St., New York, has just concluded a license for the United States and foreign countries to make, use, and sell under the Armstrong Patents Nos. 1,997,538 and 2,044,742 for the manufacture of clad products, plates, sheets, etc., using the electrolytic iron bonding or welding method, which process has been used by the Latrobe Electric Steel Company for the past few years, and recently by Jessop Steel Company.

**Attwood Brass Works,** Grand Rapids, Mich., have built an addition to their plating room. This firm operates the following departments: bronze, brass and aluminum foundry; brass machine shop, tool room, cutting-up shop, soldering, brazing, tinning, grinding, polishing and buffing, electroplating, lacquering, japanning and enameling.

**Precision Casting Co., Inc.,** Fayetteville, Syracuse, N. Y., manufacturer of die castings has let contract for structural steel framing for one-story addition, to cost about $40,000 with equipment. This firm operates a die casting shop.

**United Steel & Wire Co.,** Fonda Ave., Battle Creek, Mich., manufacturer of wire goods, steel shelving and kindred products, has let contract for two one-story additions, one for galvanizing and tinning divisions and the other for general operating service and inspection. The company will also make extensions and improvements in storage and distributing facilities. G. J. Genebach is president. The following departments are operated: smelting and refining, tool room, zincing, soldering, brazing, tinning, grinding, polishing and buffing, electroplating, japanning, enameling.

**The Metalead Products Corp.,** San Francisco, Calif., have completed a factory at Sunnvale, Calif., for the manufacture of lead-leaf paste, a pigment said to be highly resistant to alkalies and most acids.

**Atlantic Brass and Copper Co.,** wholesale jobbers of metals, announce the removal of their office and warehouse to larger quarters at 140 Grand Street, New York, under the supervision of **H. M. Schwartz.** This concern, one of the country's large surplus metal houses, handles sheet aluminum, brass, copper, zinc and steel; also circles in various sizes.

**William Cordes Synder, Jr.,** who has been with the Lewis Foundry & Machine Co., Groveton, Pa., since 1927, has been elected vice-president and manager of roll sales.

**Glyco Products Co. Inc.,** 148 Lafayette St., New York City, announce the engagement of a leading polish chemist of Germany, and are prepared to

help manufacturers of all types of polishes who desire to improve, change or add to their lines. This service, it is stated, is absolutely free.

**Ira A. Snyder,** 50 Church Street, New York, is interested in information on a fairly comprehensive plating plant and supplies for export. Full particulars are required.

A change in name has been made from the **Magnetic Manufacturing Company** of Milwaukee, Wisc., to **Stearns Magnetic Mfg. Company,** although the former company is maintained as a separate corporate entity. **H. W. Harman,** for many years head of the engineering and research departments of the Stearns Co. has been transferred to sales department in the capacity of sales engineer with supervision of the purchasing department. The plant has been enlarged to provide increased facilities for the manufacture of magnetic separators, magnetic clutches, brakes, etc. R. N. Stearns is sales manager.

**J. C. Miller Company,** 528 Lake Michigan Dr., N.W., Grand Rapids, Mich., announce the appointment of new representatives as follows: **R. Wallace Smith,** 1836 Euclid Ave., Cleveland, Ohio; **R. L. Redmond,** Stormfeltz-Lovely Building, Detroit, Mich.; **Richard H. Alden,** 1812 Pilgrim Rd., Toledo, Ohio.

**McCallum-Hatch Bronze Co.,** Buffalo, N. Y., have relocated their office at 242 Fourth Street, Buffalo, and constructed a new laboratory in the main plant.

**S. O. Otrich Co.,** 119 New Montgomery St., San Francisco, Calif., have been appointed sales representatives by the **Stearns Magnetic Mfg. Co.,** Milwaukee, Wisc.

The **Stearns Magnetic Mfg. Co.,** Milwaukee, have opened a sales office in Philadelphia, in charge of James Whiting, 369 Architects Bldg.

**Chase Metals Works,** Waterbury, Conn., will erect shortly an addition to their plant, 460′ x 60′ built of steel, transite and brick with a wood block floor. It will be used primarily for tube inspection, rod stock and some shipping.

**Leeds & Northrup Co.,** Philadelphia, Pa., announce a new branch office at 804 Judd Bldg., 75 Pearl St., Hartford, Conn.

**W. Offermanns,** general manager of "Schumag," Aachen, Germany, maker of continuous rod making machines and rod straightening and polishing machines, has arrived in New York, and will visit non-ferrous and ferrous rod mills. He will make his headquarters at the office of **W. A. Schuyler,** 230 W. 57th St., New York, the company's representative in this country.

**Wire and Metal Mfg. Co.,** 530 Riverside Dr., Glendale, Calif., will build a factory in the Vernon district, Los Angeles. Light structural steel, sheet metal and stampings and wire products, will be fabricated in the new plant. This firm operates the following departments: cutting-up shop, stamping, soldering, tinning, electroplating, lacquering, japanning and enameling.

**Vulcan Mfg. Co.,** Birmingham, Ala., manufacturer of metal cabinets, milk bottle crates and kindred products has leased building at 2200 Avenue D, Ensley, Ala., and will remodel for new plant. **W. A. McCutchen** is head. The following departments are operated; tool room, stamping, metal spraying and lacquering.

**Laco Oil Burner Co.,** Griswold, Iowa, manufacturer of oil burners and parts, oilburning equipment and systems, plans one-story addition, 165 x 230 ft. Cost over $65,000 with machinery. This firm operates the following departments: brass machine shop, tool room, cutting-up shop, stamping, soldering, tinning, metal spraying, grinding, polishing and buffing, electroplating and enameling.

**Robert W. Hunt Co.,** inspecting, testing and consulting engineers, 2200 "Insurance Exchange," Chicago, has appointed Frederick S. Cook, Pacific coast manager.

**Black & Decker Mfg. Co.,** Towson, Md., announce the payment of a Christmas bonus on December 1st of two weeks extra salary or wages figured at present rates of pay, to reward their loyal organization for their co-operation during the past depression.

**Stearns Magnetic Mfg. Co.,** Milwaukee, Wisc., announce a five per cent bonus in the form of additional compensation for all of their employees as a reward for the spirit of co-operation shown during the past year.

The second in a series of demonstrations before trade groups showing how porcelain enamel is fused on metal will be conducted under the auspices of the **Porcelain Enamel Institute** during the National House Furnishing Show at the Stevens Hotel, Chicago, Ill., January 10-16. The central feature of this exhibit is a miniature porcelain enameling furnace heated to 1560 deg. F., in which souvenir ash trays are fired.

# News From Metal Industry Correspondents

## New England States

### Waterbury, Connecticut

November 20, 1936.

Employment in local factories showed another gain in October. For over a year now every month has shown a gain. The number working in all plants employing 65 or more was 35,530, only 500 less than in the peak month of 1929. This is an increase of 1,011 over September and of 3,266 over October last year. In the eight largest factories 19,738 were employed in October, an increase of 726 over the previous month and an increase of 2,320 over October last year.

Freight tonnage in October amounted to over 66,000 tons received and over 13,000 tons forwarded, showing an increase over the previous month of 6,000 and 2,000 tons respectively.

**John H. Goss,** vice president of the **Scovill Mfg. Co.,** representing the Connecticut Manufacturers Association, appeared before the special session of the legislature this month to urge adoption of the unemployment insurance bill drawn up by the Governor's commission. This calls for joint contributions by employers and employees as opposed to the bill sponsored by labor which calls for the entire burden to be borne by the employers.

**Ralph P. White** of Winyah Street, a caster at the **Chase Metal Works,** was electrocuted last month while turning on the switch to an electric furnace. Officials could not ascertain how the accident happened, the first of its kind since the furnace control board was installed in 1924.

**John H. Goss,** vice president of the **Scovill Mfg. Co.,** was one of the speakers at the 12th annual conference of the New England council Nov. 19 in Boston. He spoke on "Assuring an Adequate Supply of Skilled Labor for Industry." He has recently pointed out that a shortage of skilled and semi-skilled labor exists here.

The **Chase Brass & Copper Co.** has started construction of a storage and shipping plant at the Chase Metal Works, 460 by 60 feet.—**W. R. B.**

### Connecticut Notes

November 20, 1936.

**NEW BRITAIN** — The **Stanley Works** of New Britain are planning an addition 75 by 275 feet to its steel rolling mill on Burritt Street.

The **Union Mfg. Co.** have started two small buildings 50 by 50 feet.

**HARTFORD** — The **Wiremold Co.** plan the erection of a two story factory building 90 by 105 feet at its Elmwood plant.

**Billings & Spencer Mfg. Co.** have asked the city to reduce from $186,396 to $75,000 the back taxes assessed

against it. This will make it possible for the company to get a $125,000 loan from the Federal Reserve bank. This would enable it to pay $75,000 in taxes and $50,000 for improvement of its plant.

**MERIDEN**—Twenty-five industrial plants here report 6,204 employees in September against 5,911 a year ago, and a gain of 300 over August. The average weekly payroll is $16,000 greater than a year ago.

The **International Silver Co.** report a net profit of $114,972 for the September quarter compared with a loss of $80,941 for the same quarter last year.

The **General Electric Co.** are planning an expansion of its production operations here and announces it expects to add 100 employees to its rolls within the next month.

**BRIDGEPORT** — The **Bridgeport Brass Co.** report earnings for the year ending Sept. 30, after taxes, depreciation and other charges, of $658,806, or 89 cents a share, an increase of over $200,000 over the previous year. Net earnings for the last quarter were nearly $100,000 over the same quarter last year.

The **Bridgeport Manufacturers Association** has reelected **George S. Hawley** as president, and reelected **W. R. Webster** as vice president. The latter is vice president of the **Bridgeport Brass Co.**

**MIDDLETOWN**—The **Russell Mfg. Co.** directors have recommended the reduction of its capital from $2,400,000 to $1,200,000 by changing the par value from $100 to $50 a share.

The former **Westinghouse** plant here, consisting of three buildings, has been leased to the **Goodyear Rubber Co.**

**TORRINGTON** — The **Torrington Co.** did a gross business, less discounts, for the year ending June 20, of $13,445,418, or 30 per cent ahead of the previous year. Net profit was $2,333,877, an increase of $300,000 over the previous year.

**NEW HAVEN**—The **New Haven Clock Co.** report sales for the first nine months of this year amounting to $2,321,358, an increase of 28 per cent over the same period last year.

**THOMASTON**—A bonus equal to one week's pay wil be given employees of the **Seth Thomas Clock Co.** Dec. 15. It will go to all who have been employed for the past six months and those employed a shorter time will receive a bonus in proportion.

**WINSTED**—The **Gilbert Clock Co.**, through **Congressman J. Joseph Smith**, are negotiating with the internal revenue bureau to seek a reduction of the tax assessed against the company. They recently obtained a large loan from the RFC.

**WALLINGFORD**—Seven industrial plants here reported 1,655 on their payrolls in September, a decrease of 158 from a year ago but an increase of 15 over August. The payrolls, however, average $5,000 more a week than a year ago.

**PLAINVILLE**—The **Plainville Foundry Co.** are planning an addition, 51 by 100 feet.—**W. R. B.**

## Providence, R. I.

November 20, 1936.

Figures measuring business conditions in Rhode Island show substantial improvement took place in the first nine months of this year as compared with the first nine months of last year. Each of the comprehensive indicators reflects business upturns, the relatively sharpest advance occurring in the building industry where the valuation of permits increased 67.8 per cent. Payrolls of workers in all industries averaged 6.3 per cent higher in the first three-quarters of this year than in the same period last year.

According to figures for the month of September released a few days ago, the number of workers in 36 manufacturing establishments in the metal trades throughout Rhode Island increased from 8,339 in September, 1935 to 9,605 in September this year, an increase of 15.2 per cent. In the manufacturing jewelry trades, 27 firms reported an increase of 2.8 per cent from 5,691 in September, 1935 as compared with 5,849 in September this year.

The first definite step in fixing the minimum wages for women and minors in industries in Rhode Island has been taken by **L. Metcalfe Walling**, Director of the State Department of Labor, acting under a State minimum wage law passed by the General Assembly at its session last spring. He has appointed a nine member board to study and recommend as well as issue directory orders for such minimum wages in the manufacturing jewelry industry. Because the United States Supreme Court some time ago declared that punitive features of a similar wage law in New York to be unconstitutional, it is stated by **Director Walling** that orders of the Minimum Wage Board would not be legally binding and that the Board could not issue mandatory orders, and that presumably employers who refused to comply could not be punished, it was hoped that compliance would be given through "public opinion."

The nine-member Board consists of three each representative of the employers, the employees and the public. The three representing the employers are: **Edward O. Otis Jr.**, executive secretary of the **New England Manufacturing Jewelers' and Silversmiths' Association** and president-treasurer of **Otis Inc.**; **Benjamin Brier**, president of the **Brier Manufacturing Company** and **Edgar E. Baker**, president-treasurer of the **W. R. Cobb Company** and president of the **Metal Findings Manufacturing Association**. The three representatives of the employees are: **Miss Alice Newton**, an employee of the **Monocraft Jewelry Company; Miss Ethel Vina Leite**, an employee of the **Ole B. Owren Company** and **Donald McCabe**, secretary of the **International Jewelry Association, Local No. 8.** The trio that will represent the public consists of: **Professor William Adams Brown, Jr.**, of Brown University; **Miss Alice Hunt**, president of the **Consumers' League of Rhode Island** and **George Hurley**, an attorney of Providence, former Assistant Attorney General of Rhode Island.

**The Pilgrim Manufacturing Company**, 155 Chestnut Street, this city, is owned and conducted by **Frederick T. Sahakian**, of 52 Burgess Avenue, East Providence.

The new electroplating class that has recently been added to the **Jewelry and Silversmithing Department** of the **Rhode Island School of Design** has met with the hearty approbation of the officials of the **New England Manufacturing Jewelers' and Silversmiths' Association** and $275 or more has been raised among the members of the Association to assist in purchasing additional equipment for the new class. This new class is a direct benefit to the manufacturing jewelry industry as there has been some time developing a real scarcity of high-class workers in this division of the industry, although the present scarcity of electro-platers has not reached serious proportions. The growing shortage is attributed partially to the increase in activity in the jewelry industry in general, but to a larger extent to the fact that jewelry plants have not been training sufficient numbers of electroplaters, and that as the older workers are lost by death or retirement there are too few younger employees able to fill the vacancies so created.

The **Manufacturers' Supply Company, Inc.**, 72 Elm Street has added a plating department to its equipment and is making a specialty of the plating of rhodium.

**William Whytock**, formerly treasurer of the **Roland & Whytock Company**, manufacturers of jewelers' findings, 24 Calender Street, has sold out his interest in that concern and has a new corporation under the name of the **William Whytock Company**, to manufacture screw machine products and jewelry findings at 67 Friendship Street.

**William G. Lind**, treasurer and general manager of the **T. W. Lind Company** of Providence, was elected a Representative from Cranston to the Rhode Island General Assembly at the election November 4.—**W. H. M.**

# Middle Atlantic States

## Central New York

November 20, 1936.

A definite upward swing in employment among the metal factories in upstate New York is noted in reports given out by Chambers of Commerce, industrial groups and other fact gathering organizations in this section of the state. The New York State Employment Service, reported that it is putting back to work three times as many men as it did last fall. **Thomas B. Bergan**, district director of WPA, in

eight upstate counties reports his number of WPA workers shrinking because in Massena practically all the men on relief have gone back to the **Aluminum Company of America** plant to work, that due to the **Oneida Community Ltd.** in Madison County that county has the lowest relief record in this vicinity with only one person in every 200 needing government help.

Rome companies are enjoying a seasonal boom. These are the concerns which deal in brass and copper.

Ilion with its concentration of **Remington Rand** workers is now the busiest the town has been for years. Meanwhile in Utica the hearing before the National Labor Relations Board continued to be held through early November where witnesses appeared in the case in which a complaint of alleged unfair labor practices is made against the **Remington-Rand.**

Fall conferences of the representatives of the **Savage Arms Corporation** and **Charles Millar & Son** were held in Utica hotels in November.—**E. K. B.**

### Newark, N. J.

November 20, 1936.

**Tube Reducing Corp.,** of Madison Avenue, has let a contract for a factory building to cost $40,000 with equipment.

**Vice Chancellor Stein** has closed the receivership which resulted in a receiver receiving a three year sentence and the resignation of two vice chancellors. The case was that of the **Earl Radio Corp.** The substitute receiver was ordered to burn the books after fees of $8,300 had been taken from the $8,754 remaining in the account. It is said that the original receiver was $149,000 short in his accounts.

The **Colloidal Corp.** of New Jersey has leased a two story factory building on Vermont Avenue for the manufacture of chemicals. **Excel Products Co.** has leased a portion of a factory building on Vesey Street for the manufacture of Neon sign equipment and lamp products.

**Theodore Walter Copper Works, Inc.,** of Newark, has been incorporated with $75,000 preferred and $50,000 common, no par.

**U. S. Bronze Powder Works,** of 220 West 42d Street, New York, has let a contract for a two and three story factory building at Closter, N. J., to cost $100,000.—**C. A. L.**

### Trenton, N. J.

November 20, 1936.

The Trenton metal industries report an increase in business for the past month. The **L. A. Young Spring and Wire Corp.,** of Detroit, Mich., will shortly erect a large plant in this city. The building will be 600 feet in length and about 250 feet in width of brick and steel. The company manufactures automobile springs and other wire articles. The concern will employ many hands.

The **Westinghouse Lamp Co.** who have been manufacturing nearly 300,000 bulbs a day will shortly increase production.

The **Crescent Insulated Wire & Cable Co., Ajax Electrothermic Corp., John A. Roebling's Sons Co.,** and the **Rubber Bearing Co., of America** had eleborate displays of goods at the recent annual convention of the **Atlantic Deeper Waterways** convention in Trenton.

The **Crescent Insulated Wire & Cable Co.,** Trenton, has let a contract for a two story brick and steel factory addition to cost $21,250.—**C. A. L.**

## Middle West

### Detroit

November 20, 1936.

Manufacturers in the non-ferrous metals are centering their thoughts at this moment on the automobile industry. The big exhibitions are on—New York, Chicago and Detroit—drawing great crowds and accompanied by forecasts that mean much for the fall and winter.

This great industry, which probably uses more brass, copper, aluminum and gray iron, than any other, seems to be plunging into an industrial program that may equal, if not exceed, that of 1929, the year preceding the great crash. Millions have been expended in the Detroit area for raw materials, machinery and other equipment to start the fall and winter program that apparently is taking the lead in directing the nation back to something like normal conditions.

Skilled mechanics are scarce and commanding the highest of wages. Unskilled labor, however, is not sharing so well, with a backwash that has difficulty finding something to do.

The accessory plants are going full swing and the same report comes from the plating industry.

The **Alloy Metal Abrasive Co.,** 311 West Huron Street, Ann Arbor, has recently been incorporated by **A. B. Bigelow,** 1144 Catherine Street, of that city.

The **National Brass Company,** Grand Rapids, is about to erect a substantial plant addition. **Harry L. Mead,** also of Grand Rapids, is the architect.

In connection with the concentration of all its manufacturing activity in one plant, **R. E. Stone,** has been named vice president in charge of manufacturing, by the **Graham-Paige Motors Corpn.** During the past five years, under Mr. Stone's supervision, a major concentration of Graham manufacturing facilities has been under way. In place of five widely separated plants, there is now one with a consequent saving in taxes, insurance, heat, light, power and overhead. **Mr. Stone,** it is announced, will direct a program of factory improvement and expansion that will provide a 50 per cent increase in production on the 1937 series.

The Lansing, Mich., plants of **Reo,** one of the oldest in the industry, have recently been rearranged under **R. J. Fitness,** works manager and chief engineer, with the result that productive capacity has been increased 50 per cent.

Plans for immediate operations in Burr Oak, Mich., are being made by the **Titan Motor Works Co.,** of Hillsdale, which has purchased the former Sheffield Corn Cutter factory building. The Titan organization manufactures motors and accessories.

The **Norge Corporation** has started construction at Muskegon on the replacement of sections of its plant recently destroyed by fire, with an estimated damage of $150,000.—**F. J. H.**

## Pacific States

### Los Angeles, Calif.

November 20, 1936.

The **Parker Machine Works** of Riverside will be moved to Santa Ana and merged with the **Paxton Nailing Machine Co.** at their factory.

The factory of **Thayer Thorndike** at 3508 Avalon Blvd., making aircraft beacons, burned and will probably be rebuilt.

**Howard Houghton,** engineer for the Douglas Aircraft Corp. at Santa Monica, has demonstrated a new method of aluminum forging, obtaining a tensile strength of 65,000 pounds per square inch, by forging parts, instead of using alloy castings.

The **West Coast Sanitary Manufacturers** of 911 East 62d St. are making a new overflow device for wash basins.

The **Ward Refrigerator & Mfg. Co.** of 6501 South Alameda St. are making beer dispenser cabinets, steel finish, chromium plated, with cooking coils.

**Guernsey & Son** are making safety signal arms for autos.

The **C. A. Cook Co.** of 2054 East 48th St. are making a wine dispenser.

The **Marbro Lamp Mfg. Co.** of 846 Wall St, have a large output now of lamp shades, part metal.

The **Coast Appliance & Mfg. Co.** are moving to 35th and Hill Sts., to have a larger output of wall heaters and enlarge the plating department.—**H. S.**

### The North Pacific

November 20, 1936.

**E. C. Davies** of 12 Hawthorne Blvd., Portland, have now a large output in valves.

The **Cutler-Hammer Co.** of Milwaukee have opened a Pacific Coast plant at 970 Folsom St., San Francisco, to manufacture all electrical specialties, F. H. Oberschmidt Pacific Coast manager, O. R. Cooke plant manager.

The **Federated Metals Corp.** at 201 First St., San Francisco, have improved and enlarged the plant.

The **Ferro Enameling Co.** of 1100 57th Ave., Oakland, are building there a factory.

The **Fisher Body Co.** of 7201 Hillside St., Oakland, are building a $20,000 addition to the factory.

**Wildberg Bros. Smelting & Refining Co.** are building a new $20,000 factory at South San Francisco.

The **Oakland Copper & Brass Works** at 1346 7th St., Oakland, are making a new type evaporator as well as a general line of equipment for canneries.

The **Pacific Brass Foundry** of San Francisco have orders for four large aluminum lanterns for the intake towers of the Hoover Dam. The lanterns are of aluminum, copper and silicon alloy, 10 feet 6 inches high, has 68 separate castings, 12 different patterns, 1,500 pounds of metal in each lantern.

The **Centre Brass Works** of 207 Centre St., New York City, have named Gus Adams, as Pacific Coast representative at 1045-17th St., San Francisco, for their solid brass fire place furnishings.

—H. S.

# Metal Market Review

November 24, 1936.

**Copper** continued to be the most active member in a generally active market. As we went to press with our last issue, the price of domestic copper had been raised to 10c per pound electrolytic, delivered Connecticut Valley. In the meantime, foreign copper continued to sell at ½ to ¾ of a cent higher, clearly an anomalous situation. Sales for October reached the record total of 180,051 tons. Finally the pressure became too great for American producers, and on Monday, November 9th the price was raised again to 10½c, this time with no advance notice of the rise.

October statistics of the Copper Institute revealed that stocks of refined metal were reduced by 23,201 tons. November sales up to November 19 totalled 82,035 tons. Foreign speculative activity is an important factor stimulated by the buying for armaments. At the time of writing, the market is not over active but decidedly on the firm side, despite some irregularity abroad.

**Zinc** has also been active. Sales in the last four weeks were 10,000 tons, 19,300 tons, 18,610 tons and 10,709 tons. These sales together with the October statistics revealing a reduction in stocks of 7,736 tons, forced the rise in price of 10 points, to 4.95c per pound Prime Western E. St. Louis, and then to 5.05.

The foreign market is strong because of negotiations for a Cartel to control production and a considerable amount of speculative activity. The domestic market has also been characterized as a "sellers market." Prospects, decidedly strong.

**Tin** began the last four-week period quite actively under the stimulus of speculative operations in London, moving upward from 43.95c per lb, Straits to 46.375 in one week then suddenly to 49.50 and up to 53.750 before reacting to about 51, where it rests at this time. For a while there seemed to be no explanation for this boiling up except buoyancy among metals generally, fear of inflation, etc., but on Nov. 5th, the International Tin Committee meeting resulted in an agreement on the tonnage basis on which Siam would become a party to the renewal of tin control. While details of the agreement were not revealed and the terms will not be stated officially until final approval has been obtained from the various governments interested, the hopes of the market ran high and the spectacular rise was explained. The next meeting is scheduled for December 11th at which time it is expected that a new agreement will be arranged beginning January first.

At the present time demand is moderate and prices irregular on rather wide fluctuations in London.

**Lead** was one of our leading climbers. On October 27, as we went to press last month, the price had been raised 10 points to 4.55c per pound E. St. Louis, and two days later to 4.65. Demand continued and shortly afterward the price was increased again to 4.75, 4.85, 4.95 and latterly 5.05 in successive rises only a few days apart, the 5.05 price taking effect November 16th. Primary cause, sales actively: 11,500 tons, 4,500 tons, 7,300 tons and 10,000 tons in the last four weeks; also the October statistics showing a reduction in stocks of 17,000 tons. Prospects strong.

**Silver** maintained its dignity by remaining unchanged in quiet trading until November 4 when Indian speculators became extremely active due to bullishness over the presidential election, raising the price about ½d. and later about another ½d., New York price followed the procession to 47½c per ounce Troy on November 9th. The price at this time 45¾; obviously all activity in the market is speculative. At the present time it is rather uncertain.

**Platinum** following its rapid drop down the greased skids last month by another reduction from $53 to $48 per ounce effective October 26. Since that date it has been very much less active and also much less in the public eye. Whether or not speculators are discouraged is impossible to say but at this time they are not lively. The "interesting" record of this metal is briefly, a rise from $32 per ounce on April 27 to $70 per ounce on September 2 and the fall to $48 per ounce by October 26.

**Scrap Metals** necessarily were excited under the stimulus of a primary market. Refiners' bids went up steadily, not only with the primary market but also because of export bids for scrap copper which were based on foreign prices, consistently above domestic. Scrap lead, zinc and tin went along in sympathy and although during the week of November 16 export bids on scrap copper dropped 50 points, they recovered again to within 15 to 20 points of the week before. American refiners are having difficulty getting metal in competition with export bids.

Brass ingot bookings have been steadily improving with prices following the increase in raw metals. Aluminum ingot has been under good steady demand, unchanged in price, but firm.

The combined deliveries of brass and bronze ingots and billets by the members of the Non-Ferrous Ingot Metal Institute for the month of October, 1936, amounted to a total of 8,025 tons.

On November 1, unfilled orders for brass and bronze ingots and billets on the books of the members amounted to a total of 32,411 net tons.

Average prices per pound received by the membership on Commercial Grades of six principal mixtures of Ingot Brass during the twenty-eight day period ending October 30, were:

| | |
|---|---|
| 80-10-10 (1½% Imp.) | 11.044c |
| 78% Metal | 8.813c |
| 81% Metal | 9.010c |
| 83% Metal | 9.259c |
| 85% Metal | 9.520c |
| No. 1 Yellow Brass | 7.801c |

The **Wrought Metal Market** is in better condition than it has been for years. Under the stimulus of orders from the automobile industry and consumer goods, the Connecticut Valley mills are working practically to capacity. Western mills leaning more heavily on the automobile are a little slower due to a seasonal recession, but with excellent prospects directly before them. Sales of brass pipe and copper tubing for the first 10 months totalled about 360,000 lbs. more than were ever sold before in any 12 months.

A large Metropolitan distributor reports business during November to be about 1% or 2% below October, and about 25% above November, 1935.

## AVERAGE PRICES FOR METALS

| | OCTOBER |
|---|---|
| **Copper** c/lb. Duty 4c/lb. | |
| **Lake** (del. Conn. Producers, Prices) | 9.87 |
| **Electrolytic** (del. Conn. Producers' Prices) | 9.85 |
| **Casting** (f.o.b. ref.) | 9.47 |
| **Zinc.** (f.o.b. E. St. Louis) c/lb. Duty 1¾ c/lb. | |
| Prime Western (for Brass Special add 0.05) | 4.85 |
| **Tin** (f.o.b. N. Y.) c/lb. Duty Free, Straits | 44.94 |
| **Lead** (f.o.b. St. L.) c/lb. Duty 2½ c/lb. | 4.63 |
| **Aluminum** c/lb. Duty 4 c/lb. | 20.500 |
| **Nickel** c/lb. Duty 3 clb. Electrolytic 99.9% | 35.00 |
| **Antimony** (Ch. 99%) c/lb. Duty 2c/lb. | 12.50 |
| **Silver** c/oz. Troy, Duty Free | 44.750 |
| **Platinum** $/oz. Troy, Duty Free | 52.62 |
| **Gold**—Official U. S. Treasury Price $/oz. Troy | 35.00 |

# Metal Prices, November 24, 1936

(Import duties and taxes under U. S. Tariff Act of 1930, and Revenue Act of 1932)

## NEW METALS

**Copper:** Lake, 10.625, Electrolytic, 10.50, Casting, 10.125. **Zinc:** Prime Western, 5.05. Brass Special, 5.15. **Tin:** Straits 51.875. **Lead:** 5.05. **Aluminum,** 19-22. **Antimony,** 12.50. **Nickel:** Shot, 36. Elec., 35.

**Quicksilver:** Flasks, 75 lbs., $95. **Bismuth,** $1.00. **Cadmium,** 75c to 80c. **Silver,** Troy oz., official price, N. Y., Nov. 25, 45.125c. **Gold:** Oz. Troy, Official U. S. Treasury price, Oct. 27, $35.00. **Scrap Gold,** 6¾c. per pennyweight per karat, dealers' quotation. **Platinum,** oz. Troy, $48.00.

Duties: Copper, 4c lb.; zinc, 1½c. lb.; tin, free, lead, 2½c. lb.; aluminum, 4c lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

## INGOT METALS AND ALLOYS

| | Cents lb. | U. S. Import Duty | U. S. Import Tax* |
|---|---|---|---|
| No. 1 Yellow Brass | 8.75 | None | 4c. lb.[1] |
| 85-5-5-5 | 10.75 | None | 4c. lb.[1] |
| 88-10-2 | 14.75 | None | 4c. lb.[1] |
| 80-10-10 | 12.50 | None | 4c. lb.[1] |
| Manganese Bronze (60,000 t. s. min.) | 10.75 | None | 4c. lb.[1] |
| Aluminum Bronze | 15 | None | 4c. lb.[1] |
| Monel Metal Shot or Block | 28 | 25% a. v. | None |
| Nickel Silver (12% Ni) | 12.50 | 20% a. v. | 4c. lb.[1] |
| Nickel Silver (15% Ni) | 15.00 | 20% a. v. | 4c. lb.[1] |
| No. 12 Aluminum | 19-25 | 4c. lb. | None |
| Manganese Copper, Grade A (30%) | 19-25 | 25% a. v. | 3c. lb.[1] |
| Phosphor Copper, 10% | 13-15 | 3c. lb. | 4c. lb.[1] |
| Phosphor Copper, 15% | 14-16 | 3c. lb. | 4c. lb.[1] |
| Silicon Copper, 10% | 18-30 | 45% a. v. | 4c. lb.[1] |
| Phosphor Tin, no guarantee | 57-75 | None | None |
| Iridium Platinum, 5% (Nominal) | $53.00 | None | None |
| Iridium Platinum, 10% (Nominal) | $58.00 | None | None |

* Duty is under U. S. Tariff Act of 1930; tax under Section 60 (7) of Revenue Act of 1932.
[1] On copper content. [2] On total weight. "a. v." means ad valorem.

## OLD METALS

| Dealers' buying prices, wholesale quantities: | Cents lb. | Duty | U. S. Import Tax |
|---|---|---|---|
| Heavy copper and wire, mixed. | 8⅛to 8⅜ | Free | 4c. per pound on copper content |
| Light copper | 7½to 7¾ | Free | |
| Heavy yellow brass | 5 to 5¼ | Free | |
| Light brass | 4⅝to 4⅞ | Free | |
| No. 1 composition | 7 to 7¼ | Free | |
| Composition turnings | 6½to 6¾ | Free | |
| Heavy soft lead | 4⅜to 4½ | 2⅛c.lb. | |
| Old zinc | 2½to 2⅝ | 1½c.lb. | |
| New zinc clips | 3½to 3¾ | 1½c.lb. | |
| Aluminum clips (new, soft) | 13½to14 | 4c.lb. | |
| Scrap aluminum, cast | 12 to12¼ | 4c.lb. | |
| Aluminum borings—turnings | 6 to 6¼ | 4c.lb. | None |
| No. 1 pewter | 35 to 36 | Free | |
| Electrotype | 4⅝to 4¾ | 2⅛c.lb.* | |
| Nickel anodes | 24 to 25 | 10% | |
| Nickel clips, new | 33 to 35 | 10% | |
| Monel scrap | 8½to 15 | 10%av. | |

* On lead content.

# Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacturers' price lists, effective since November 7, 1936. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 pounds; on nickel silver, from 1,000 to 2,000 pounds.

## COPPER MATERIAL

| | Net base per lb. | Duty* |
|---|---|---|
| Sheet, hot rolled | 18¼c. | 2½c. lb. |
| Bare wire, soft, less than carloads | 14¼c. | 25% a. v. |
| Seamless tubing | 18¾c. | 7c. lb. |

* Each of the above subject to import tax of 4c. lb. in addition to duty, under Revenue Act of 1932.

## NICKEL SILVER

Net base prices per lb. (Duty 30% ad valorem.)

| Sheet Metal | | Wire and Rod | |
|---|---|---|---|
| 10% Quality | 25½c. | 10% Quality | 28⅛c. |
| 15% Quality | 27⅝c. | 15% Quality | 32½c. |
| 18% Quality | 28⅞c. | 18% Quality | 35¾c. |

## BRASS AND BRONZE MATERIAL

| | Yellow Brass | Red Brass 80% | Comm'l. Bronze | Duty | U. S. Import Tax |
|---|---|---|---|---|---|
| Sheet | 16¼c. | 17⅛c. | 18⅛ | 4c. lb. | 4c. lb. on copper content. |
| Wire | 16½c. | 17⅜c. | 18⅜ | 25% | |
| Rod | 14¼c. | 17⅜c. | 18¼ | 4c. lb. | |
| Angles, channels. | 24 c. | 25⅛c. | 25⅞ | 12c. lb. | |
| Seamless tubing.. | 18½c. | 19⅛c. | 20⅛ | 8c. lb. | |
| Open seam tubing | 24 c. | 25⅛c. | 25⅞ | 20% a.v. | |

## TOBIN BRONZE AND MUNTZ METAL

(Duty 4c. lb.; import tax 4c. lb. on copper content.)

| Net base prices per pound. | |
|---|---|
| Tobin Bronze Rod | 18⅛c. |
| Muntz or Yellow Rectangular and other sheathing | 19½c. |
| Muntz or Yellow Metal Rod | 15⅝c. |

## ALUMINUM SHEET AND COIL

(Duty 7c. per lb.)

| | |
|---|---|
| Aluminum sheet, 18 ga., base, ton lots, per lb. | 32.80 |
| Aluminum coils, 24 ga., base price, ton lots, per lb. | 30.50 |

## ROLLED NICKEL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Net Base Prices

| | | | |
|---|---|---|---|
| Cold Drawn Rods | 49c. | Cold Rolled Sheet | 53c. |
| Hot Rolled Rods | 44c. | Standard Sheet | 48c. |

## MONEL METAL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

| | | | |
|---|---|---|---|
| Hot Rolled Rods (base) | 34 | Standard Sheets (base) | 38 |
| Cold Drawn Rods (base) | 39 | Cold Rolled Sheets (base) | 43 |

## SILVER SHEET

Rolled sterling silver (Nov. 25) 47¼c. per Troy oz. upward according to quantity. (Duty, 65% ad valorem.)

## ZINC AND LEAD SHEET

| | Cents per lb. Net Base | Duty |
|---|---|---|
| Zinc sheet, carload lots, standard sizes and gauges, at mill, less 7 per cent discount | 9.50 | 2c. lb. |
| Zinc sheet, 1200 lb. lots (jobbers' price) | 10.25 | 2c. lb. |
| Zinc sheet, 100 lb. lots (jobbers' price) | 14.25 | 2c. lb. |
| Full Lead Sheet (base price) | 8.50 | 2¾c. lb. |
| Cut Lead Sheet (base price) | 8.75 | 2¾c. lb. |

## BLOCK TIN, PEWTER AND BRITANNIA SHEET

(Duty Free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

| | |
|---|---|
| 500 lbs. over | 15c. above N. Y. pig tin price |
| 100 to 500 lbs. | 17c. above N. Y. pig tin price |
| Up to 100 lbs. | 25c. above N. Y. pig tin price |
| Up to 100 lbs. | 25c. above N. Y. pig tin price |

Supply Prices on page 505.

# Supply Prices, November 24, 1936

## ANODES

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 500 lbs. or more, and subject to changes due to fluctuating metal markets.

| | | | |
|---|---|---|---|
| **Copper:** | Cast | 17¾c. per lb. | **Nickel:** 90-92% .45 per lb. |
| | Electrolytic, full size, 16c. cut to size | 16 c. per lb. | 95-97% .46 per lb. |
| | Rolled oval, straight, 16½c.; curved | 17½c. per lb. | 99%+cast, 47c.; rolled, depolarized, 48. |
| **Brass:** | Cast | 18¼c. per lb. | **Silver:** Rolled silver anodes .999 fine were quoted Nov. 25, from 48½c. per Troy ounce upward, depending on quantity. |
| **Zinc:** | Cast | 10⅛c. per lb. | |

## WHITE SPANISH FELT POLISHING WHEELS

| Even Diameters | Thickness | Under 50 lbs. | 50 to 100 lbs. | Over 100 lbs. |
|---|---|---|---|---|
| 10-12-14 & 16 | 1" to 2" | $2.35/lb. | $2.23/lb. | $2.12/lb. |
| 10-12-14 & 16 | 2 to 3½ | 2.35 | 2.23 | 2.12 |
| 6-8 & 18 | 1 to 2 | 2.35 | 2.23 | 2.12 |
| 6-8 & 18 | 2 to 3½ | 2.35 | 2.23 | 2.12 |
| Over 18 | Under ½ | 3.80 | 3.61 | 3.42 |
| Over 18 | ½ to 1 | 3.45 | 3.28 | 3.11 |
| Over 18 | Over 3½ | 2.80 | 2.66 | 2.52 |
| | **Odd Diameters** | | | |

Less than 50 lbs.—add 40c. per lb. to "Even Diameters" list. 50 lbs. or over—all one size and consistency and in one shipment —same as "Even Diameters."

Extras: 25c per lb. on wheels, 1 to 6 in. diam., over 3 in. thick. On grey Mexican wheels deduct 10c. per lb. from above prices.

## COTTON BUFFS

Full disc open buffs, per 100 sections when purchased in lots of 100 or less are quoted:

| | |
|---|---|
| 16" 20 ply 84/92 Unbleached | $78.28 |
| 14" 20 ply 84/92 Unbleached | 59.99 |
| 12" 20 ply 84/92 Unbleached | 45.08 |
| 16" 20 ply 80/92 Unbleached | 65.25 |
| 14" 20 ply 80/92 Unbleached | 50.08 |
| 12" 20 ply 80/92 Unbleached | 37.72 |
| 16" 20 ply 64/68 Unbleached | 55.77 |
| 14" 20 ply 64/68 Unbleached | 42.88 |
| 12" 20 ply 64/68 Unbleached | 32.37 |
| ⅜" Sewed Buffs, per lb., bleached or unbleached | 48c. to 1.12 |

## CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

| | | |
|---|---|---|
| Acetone C. P. | lb. | .08½-.13½ |
| Acid—Boric (Boracic) granular, 99½+% ton lots | lb. | .05¼-.05¾ |
| Chromic, 400 or 100 lb. drums | | .16¾ |
| Hydrochloric (Muriatic) Tech., 20 deg., carboys | lb. | .03 |
| Hydrochloric, C. P., 20 deg., carboys | lb. | .06½ |
| Hydrofluoric, 30%, bbls. | lb. | .07-.08 |
| Nitric, 36 deg., carboys | lb. | .05-.06¼ |
| Nitric, 42 deg., carboys | lb. | .07-.08 |
| Sulphuric, 66 deg., carboys | lb. | .029 |
| Alcohol—Butyl, drums | lb. | .09½-.12 |
| Denatured, drums | gal. | .30-.476 |
| Alum—Lump, barrels | lb. | .03¼-.03½ |
| Powdered, barrels | lb. | .0340-.0365 |
| Ammonia, aqua, com'l., 26 deg., drums, carboys | lb. | .02½-.05 |
| Ammonium—Sulphate, tech., bbls. | lb. | .03½-.05 |
| Sulphocyanide, technical crystals, kegs | lb. | .55-.58 |
| Arsenic, white kegs | lb. | .04½-.05 |
| Asphaltum, powder, kegs | lb. | .23-.41 |
| Benzol, pure, drums | gal. | .41 |
| Borax, granular, 99½+%, ton lots | lb. | .0245-.0295 |
| Cadmium oxide, 50 to 1,000 lbs. | lb. | 1.05 |
| Calcium Carbonate (Precipitated Chalk), U. S. P. | lb. | .05¾-.07½ |
| Carbon Bisulphide, drums | lb. | .05½-.06 |
| Chrome, Green, commercial, bbls. | lb. | .21½-.23½ |
| Chromic Sulphate, drums | lb. | .33-.55 |
| Copper—Acetate (Verdigris) | lb. | .28 |
| Carbonate, 53/55% cu., bbls. | lb. | .15½ |
| Cyanide (100 lb. kgs.) | lb. | .37-.40 |
| Sulphate, tech., crystals, bbls. | lb. | .04½-.05 |
| Cream of Tartar Crystals (Potassium Bitartrate) | lb. | .20¼-.20½ |
| Crocus Martis (Iron Oxide) red, tech., kegs | lb. | .07 |
| Dextrin, yellow, kegs | lb. | .05-.08 |
| Emery Flour | lb. | .06½ |
| Flint, powdered | ton | 30.00 |
| Fluorspar, bags | lb. | .03½ |
| *Gold Chloride | oz. | $18¼-23 |
| *Gold Cyanide, Potassium | | $15.45 |
| *Gold Cyanide, Sodium | | $17.10 |
| Gum—Sandarac, prime, bags | lb. | .50 |
| Shellac, various grades and quantities | lb. | .21-.31 |
| Iron Sulphate (Copperas), bbls. | lb. | .016 |
| Lead—Acetate (Sugar of Lead), bbls. | lb. | .10-.13½ |
| Oxide (Litharge), bbls. | lb. | .12½ |
| Lime Compositions for Nickel | lb. | .09½-.11 |
| Lime Compositions for Brass | lb. | .09½-.11 |
| Mercury Bichloride (Corrosive Sublimate) | lb. | $1.58 |
| Methanol, (Wood Alcohol) Pure, drums | gal. | .42½ |
| Nickel—Carbonate, dry, bbls. | lb. | .36-.41 |
| Chloride, bbls. | lb. | .18-.22 |
| Salts, single, 425 lb. bbls. | lb. | .13¼-.14½ |
| Salts, double, 425 lb. bbls. | lb. | .13½-.14½ |
| Paraffin | lb. | .05-.06 |
| Phosphorus—Duty free, according to quantity | lb. | .35-.40 |
| Potash Caustic Electrolytic 88-92% broken, drums | lb. | .07¼-.08⅝ |
| Potassium—Bichromate, casks (crystals) | lb. | .09 |
| Carbonate, 96-98% | lb. | .07⅜ |
| Cyanide, 165 lbs. cases, 94-96% | lb. | .57½ |
| Pumice, ground, bbls. | lb. | .02½ |
| Quartz, powdered | ton | $30.00 |
| Rosin, bbls. | lb. | .04½ |
| Sal Ammoniac (Ammonium Chloride) in bbls. | lb. | .05-.07¼ |
| *Silver—Chloride, dry, 100 oz. lots | oz. | .38¾ |
| Cyanide, 100 oz. lots | oz. | .47½ |
| Nitrate, 100 ounce lots | oz. | .33⅜ |
| Soda Ash, 58%, bbls. | lb. | .0225 |
| Sodium—Cyanide, 96 to 98%, 100 lbs. | lb. | .17½-.22 |
| Hyposulphite, kegs, bbls. | lb. | .03½-.06½ |
| Metasilicate, granular, bbls. | lb. | 2.55-3.15 |
| Nitrate, tech., bbls. | lb. | .02¼ |
| Phosphate, tribasic, tech., bbls. | lb. | .03 |
| Silicate (Water Glass), bbls. | lb. | .01½ |
| *Stannate, drums | lb. | .34-.37 |
| Sulphocyanide, drums | lb. | .30-.45 |
| Sulphur (Brimstone), bbls. | lb | .02¾ |
| *Tin Chloride, 100 lb. kegs | lb. | .38½ |
| Tripoli, powdered | lb. | .03 |
| Trisodium Phosphate—see Sodium Phosphate. | | |
| Wax—Bees, white, ref. bleached | lb. | .60 |
| Yellow, No. 1 | lb. | .45 |
| White Silica Compositions for Brass | lb. | .07½-.10 |
| Whiting, Bolted | lb. | .02½-.06 |
| Zinc—Carbonate, bbls. | lb. | .11-.12 |
| Cyanide (100 lb. kegs) | lb. | .36-.38 |
| Chloride, drums, bbls. | lb. | .06 |
| Sulphate, bbls. | lb. | .033 |

*Subject to fluctuations in metal prices.

# INDEX TO VOLUME 34

## January-December, 1936

## The Metal Industry Publishing Company, New York

ARTICLES ASTERISKED (*) ARE ILLUSTRATED

### ARTICLES


#### A

*50 Years, Aluminum After ... 54
*1935, The Metal Markets in ... 40
Abrasives Used in the Polishing and Buffing of Metals ... 304
Accelerated Cold Cracking Test for Finishes ... 214
*Advances in Electroplating ... 8
Alloy for Wire in Electrical Resistance Standards, New ... 175
*Alloy, The Effect of the Addition of Lead on the Endurance Limit of a Certain Tin-Base Bearing ... 431
Alloys Applicable to the Chemical Industry, New Metals and ... 383
*Alloys, Beryllium-Copper-Cobalt ... 226
Alloys, Chemical Compositions of Copper-Base ... 139
Alloys Containing Cadmium ... 95
Alloys in the Zinc Bath ... 336
Alloys, Magnesium Base ... 62
*Alloys, Nickel and Its Non-Ferrous ... 42
Alloys, Notes on Low Melting Point ... 335
Alloys, Plating Rhenium and Rhenium-Nickel ... 176
Alloys, Recommended Practice for Common Aluminum-Copper ... 15, 94, 127
*Alloys, Recommended Practices for Sand Cast Magnesium ... 426, 471
Alloys, Thermal Expansion of Copper-Beryllium ... 260
*Aluminum ... 6
*Aluminum After 50 Years ... 54
*Aluminum Alloy Pistons, High Production Methods for Manufacturing Anodized ... 103
Aluminum Bronzes and Their Heat Treatment ... 250
Aluminum-Copper Alloys, Recommended Practice for Common ... 15, 94, 127
*Aluminum Name Plates ... 327
*Aluminum Withstands Floods ... 167A
Amalgam, Refining Silver ... 435
*American Crucible Business, A History of the ... 47A
*American Electro-Platers' Society Holds Annual Meeting in Cleveland ... 207
*American Foundrymen's Association Annual Convention in Detroit ... 182
American Foundrymen's Association Convention in Detroit ... 217
American Society for Testing Materials Meeting ... 254
*Amperehour Meter Method, Plating by the ... 387
*Annealing of Brass and Copper, Electric ... 12
*Annealing of High Brass, The Effect of Iron Impurities on the ... 333
Annealing, Silver to Protect Steels During ... 100
*Anodized Aluminum Alloy Pistons, High Production Methods for Manufacturing ... 103
Army and Navy Identification Discs ... 181
*Art of Metal Spinning, The ... 285
Association Convention in Detroit, American Foundrymen's ... 217
*Automatic Lacquering, Enameling and Japanning ... 247
*Automatic Soldering Conveyor ... 293

#### B

Barrel Burnishing ... 101
Bath, Alloys in the Zinc ... 336
*Bearing Alloy, The Effect of the Addition of Lead on the Endurance Limit of a Certain Tin-Base ... 431
Bearing Bronze ... 388
*Bek Process, The ... 295
Beryllium Alloys, Thermal Expansion of Copper- ... 260
*Beryllium-Copper-Cobalt Alloys ... 226
Beryllium Developments ... 7
Bethlehem Process of Electrogalvanizing Round Steel Wire ... 172
Bolts, Hot Galvanizing ... 16
Borax, Removing ... 181
Brass and Bronze, Melting and Pouring of ... 430
*Brass and Copper, Electric Annealing of ... 12
Brass Castings, Hard and Soft Spots in ... 335
*Brass Fabrication ... 4
Brass Fittings for Tubes, Standards for ... 221
Brass Founders' Manual Correction ... 95
Brass Foundry Digest, Practical 23, 67, 109, 146, 189, 231, 269, 309, 352, 397, 444, ... 487
Brass Foundry Practice, Nickel in ... 330
*Brass Foundry, The ... 2
Brass Foundryman's Progress, A ... 130, 291
Brass, Hot Tinning of ... 440
Brass Machining ... 8
Brass Man, Of Interest to the Veteran ... 297
*Brass Manufacture, Copper and ... 40
*Brass Mill Equipment ... 3
Brass, Recovering Copper and Zinc from ... 440
*Brass Rolling ... 3
Brass Shells, Cracking ... 59
Brass, Spotted ... 14
*Brass, The Effect of Iron Impurities on the Annealing of High ... 333
Brass Tubes, Spinning ... 225
Brazing Fluxes ... 167A
Bright Dip for Cast Bronze ... 392
Bright Dip for Steel ... 390
British Institute of Metals Meeting ... 136
British Institute of Metals Meeting ... 385
Bronze, Bearing ... 388
Bronze, Bright Dip for Cast ... 392
Bronze Castings, Manganese ... 382
Bronze Castings, Proposed Revision QQ-B-691 Federal Specification for ... 288
Bronze, Melting and Pouring of Brass and ... 430
Bronzes and Their Heat Treatment, Aluminum ... 250
Buffing of Metals, Abrasives Used in the Polishing and ... 304
Burnishing, Barrel ... 101
Burnishing Procedure ... 301

#### C

Cadmium, Alloys Containing ... 95
Cadmium Coatings on Steel, Protective Value of Zinc and ... 129
Cadmium, Refining ... 216
Calendar of Events of Importance to the Metal Industries, A ... 17
Cast Bronze, Bright Dip for ... 392
Cast Iron, Tinning ... 304
*Cast Magnesium Alloys, Recommended Practices for Sand ... 426, 471
Casting in Plaster Molds ... 138
Casting Pure Nickel ... 257
Casting Pure Nickel ... 294
Casting, Slush ... 337
Castings, Hard and Soft Spots in Brass ... 335
Castings, Manganese Bronze ... 382
Castings, Proposed Revision QQ-B-691, Federal Specification for Bronze ... 288
Chemical Compositions of Copper-Base Alloys ... 139
Chemical Industry, New Metals and Alloys Applicable to the ... 383
Chromium Plating Patent Suit, General Motors Win ... 389
Cleaning Before Retinning ... 216
Cleaning Stereotype ... 425
*Cleveland, American Electro-Platers' Society Holds Annual ... 207
*Cleveland, Electroplaters' Convention in ... 161
Coating Copper, Lead ... 292
Coatings, Measuring the Thickness of Metal ... 135
*Coatings, Methods for Determining the Thickness of Zinc ... 173
Coatings on Steel, Protective Value of Zinc and Cadmium ... 129
*Cobalt Alloys, Beryllium-Copper- ... 226
Cold Cracking Test for Finishes, Accelerated ... 214
Comparative Evaluation of Modern Finishes, The ... 437
Compositions of Copper-Base Alloys, Chemical ... 139
*Congress, National Metal ... 417
Content of Plating Salts, Metal ... 337
*Convention in Cleveland, Electroplaters' ... 161
Convention in Detroit, American Foundrymen's Association ... 217
*Convention in Detroit, American Foundrymen's Association Annual ... 182
*Conveyor, Automatic Soldering ... 293
Copper Alloys, Recommended Practice for Common Aluminum- ... 15, 94, 127
*Copper and Brass Manufacture ... 40
Copper and Zinc from Brass, Recovering ... 440
Copper-Base Alloys, Chemical Compositions of ... 139
Copper-Beryllium Alloys, Thermal Expansion of ... 260
*Copper-Cobalt Alloys, Beryllium ... 226
Copper, Cyanide ... 287
*Copper, Electric Annealing of Brass and ... 12
Copper, Hot Tinning of ... 438
Copper, Lead Coating ... 292
Correction, Brass Founders' Manual ... 95
Correction—Cyanide Poisoning ... 386
Corrosion of Metals in Soils ... 482
Corrosion of Solder ... 104
Cost of Finishing Operations, Direct Labor ... 342
Cracking Brass Shells ... 59
Cracking Test for Finishes, Accelerated Cold ... 214
*Crucible Business, A History of the American ... 47A
*Current for Plating, Metal Rectifiers to Supply ... 261
Cyanide Copper ... 287
Cyanide, From Silver to Silver ... 345
Cyanide Poisoning ... 346
Cyanide Poisoning—Correction ... 386

#### D

Deliquescent Tin Dross Samples, A Suggested Method for Preparing ... 338
*Determining the Thickness of Zinc Coatings, Methods for ... 173
*Detroit, American Foundrymen's Association Annual Convention in ... 182
Detroit, American Foundrymen's Association Convention in ... 217
*Detroit, Foundrymen Will Meet in ... 123
*Developments in Tin ... 5
Diesel Engine in the Plating Plant, The ... 344
Digest, Practical Brass Foundry 23, 67, 109, 146, 189, 231, 269, 309, 352, 397, 444, ... 487
Dip for Cast Bronze, Bright ... 392
Dip for Steel, Bright ... 390
Direct Labor Cost of Finishing Operations ... 342
Discs, Army and Navy Identification ... 181
*Division Meeting, Institute of Metals ... 87
Down-Draft Furnace Melting ... 467
Dross Samples, A Suggested Method for Preparing Deliquescent Tin ... 338

#### E

*Effect of Iron Impurities on the Annealing of High Brass ... 333
Effect of Surface Treatment on Metals ... 100
*Effect of the Addition of Lead on the Endurance Limit of a Certain Tin-Base Bearing Alloy ... 431
*Electric Annealing of Brass and Copper ... 12
Electric Furnace, The ... 132
Electrical Fittings, Specifications for ... 224
Electrical Resistance Standards, New Alloy for Wire in ... 175
Electrochemical Society Meeting ... 178
Electrochemical Society Meeting ... 436
Electrodeposition of Iron, Rapid ... 302
Electrogalvanizing Round Steel Wire, Bethlehem Process of ... 172
*Electrogalvanizing Round Wire ... 168
*Electrometallurgy ... 9
*Electro-Platers' Convention in Cleveland ... 161
*Electro-Platers' Institute Annual Meeting, Master ... 167
Electro-Platers' Institute, Master ... 214
*Electro-Platers' Society Holds Annual Meeting in Cleveland, American ... 207
*Electroplates, A New Method of Measuring ... 258
*Electroplating ... 9
*Electroplating ... 10
*Electroplating, Advances in ... 8
*Electroplating Generators, "Trouble-Shooting" on ... 339
*Electroplating in Great Britain ... 11
*Electroplating Industry, The Jobbing ... 10
Electroplating Research Progress ... 439
Electroplating Solutions, The pH of ... 473
*Enameling, Porcelain ... 96
*Enameling and Japanning, Automatic Lacquering ... 247
Enamels, Hairlining of Vitreous ... 391
Enamels, Synthetic ... 60
Engine in the Plating Plant, The Diesel ... 344
*Equipment, Brass Mill ... 3
Estimate Job Plating, How to ... 225
Evaluation of Modern Finishes, The Comparative ... 437
Events of Importance to the Metal Industries, A Calendar of ... 17
Exhibits, Prizes for ... 264
Expansion of Copper-Beryllium Alloys, Thermal ... 260
Expansion of Metals ... 129
Exposure Tests of Plating on Non-Ferrous Metals ... 302

#### F

*Fabrication, Brass ... 4
Federal Specification for Bronze Castings, Proposed Revision QQ-B-691 ... 288
Fifty-Two Years of Plating ... 303
"Finish" on Gears, "Glass" ... 432
Finishes, Accelerated Cold Cracking Tests for ... 214
Finishes, Specifications for ... 386
Finishes, The Comparative Evaluation of Modern ... 437
Finishing Operations, Direct Labor Cost of ... 342
Fittings for Tubes, Standards for Brass ... 221
Fittings, Specifications for Electrical ... 224
*Floods, Aluminum Withstands ... 167A
Fluxes, Brazing ... 167A
*Foundries, Usefulness of Pyrometry in Smelting Works and ... 421

Foundry Digest, Practical Brass 23, 67, 109, 146, 189, 231, 269, 309, 352, 397, 444, 487
Foundry Furnaces, Second Thoughts About.. 131
Foundry Practice, Nickel in Brass ..... 330
*Foundry, The Brass ..... 2
Foundryman's Progress, A Brass ..... 130, 291
*Foundrymen Will Meet in Detroit ..... 123
*Foundrymen's Association Annual Convention in Detroit, American ..... 182
Foundrymen's Association Convention in Detroit, American ..... 217
From Silver to Silver Cyanide ..... 345
Furnace Melting, Down-Draft ..... 467
Furnace, The Electric ..... 132
Furnaces, Second Thoughts About Foundry.. 131

## G

Galvanized Sheets for Painting, Treatment of 215
Galvanized Sheets, Treatment of ..... 337
Galvanizing Bolts, Hot ..... 16
Gears, "Glass Finish" on ..... 432
General Motors Win Chromium Plating Patent Suit ..... 389
*Generators, "Trouble-Shooting" on Electroplating ..... 339
"Glass Finish" on Gears ..... 432
*Gold and Silver ..... 42
Gold Solutions, Old ..... 184
Golds, Platinum, Etc., Heat Treatment of White ..... 167B
*Great Britain, Electroplating in ..... 11

## H

Hairlining of Vitreous Enamels ..... 391
Hard and Soft Spots in Brass Castings ..... 335
Heads Erect! ..... 1
Heads, Soldering Key ..... 253
Heat Treatment, Aluminum Bronzes and Their ..... 250
Heat Treatment of White Golds, Platinum, Etc. ..... 167B
*High Brass, The Effect of Iron Impurities on the Annealing of ..... 333
*High Production Methods for Manufacturing Anodized Aluminum Alloy Pistons ..... 103
*History of the American Crucible Business.. 47A
Hot Galvanizing Bolts ..... 16
Hot Tinning ..... 384
Hot Tinning Methods ..... 102
Hot Tinning of Brass ..... 440
Hot Tinning of Copper ..... 438
How to Estimate Job Plating ..... 225

## I

Identification Discs, Army and Navy ..... 181
*Improvements in the Metal and Plating Industries in 1935 ..... 2
*Impurities on the Annealing of High Brass, The Effect of Iron ..... 333
*Industrial Material, Rubber—a Vital ..... 477
*Ingot Metals ..... 2
Inserts, Tightening ..... 341
*Institute Annual Meeting, Master Electro-Platers' ..... 167
*Institute of Metals Division Meeting ..... 87
Institute of Metals Meeting, British ..... 136
Institute of Metals Meeting, British ..... 385
Institute, Master Electro-Platers' ..... 214
*Iron Impurities on the Annealing of High Brass, The Effect of ..... 333
Iron, Rapid Electrodeposition of ..... 302
Iron, Tinning Cast ..... 304

## J

*Japanning, Automatic Lacquering, Enameling and ..... 247
*Jewelry Manufacture ..... 7
Job Plating, How to Estimate ..... 225
*Jobbing Electroplating Industry ..... 10

## K

Key Heads, Soldering ..... 253

## L

Labor Cost of Finishing Operations, Direct .. 342
*Lacquering, Enameling and Japanning, Automatic ..... 247
*Lead ..... 5
*Lead and Tin ..... 5
Lead Coating Copper ..... 292
*Lead on the Endurance Limit of a Certain Tin-Base Bearing Alloy, The Effect of the Addition of ..... 431
Lead, Specifications for ..... 224
Low Melting Point Alloys, Notes on ..... 335

## M

Machining, Brass ..... 8
*Magnesium Alloys, Recommended Practices for Sand Cast ..... 426, 471
Magnesium Base Alloys ..... 62
Man, Of Interest to the Veteran Brass .... 297
Manganese Bronze Castings ..... 382
*Manufacturing, Practical Time Study Methods in Metal Products ..... 465
*Markets in 1935, The Metal ..... 40
Master Electro-Platers' Institute ..... 214
*Master Electro-Platers' Institute Annual Meeting ..... 167
*Material, Rubber—a Vital Industrial ..... 477
Materials Meeting, American Society for Testing ..... 254
Materials Society Committee Meetings, Testing ..... 133
*Measuring Electroplates, A New Method of 258
Measuring the Thickness of Metal Coatings .. 135
Meeting, American Society for Testing Materials ..... 254
Meeting, British Institute of Metals ..... 136
Meeting, British Institute of Metals ..... 385
Meeting, Electrochemical Society ..... 178
Meeting, Electrochemical Society ..... 436
*Meeting in Cleveland, American Electro-Platers' Society Holds Annual ..... 207
*Meeting, Institute of Metals Division .... 87
*Meeting, Master Electro-Platers' Institute Annual ..... 167
*Meeting, Newark Platers Hold Open ..... 180
Meetings, Testing Materials Society Committee ..... 133
Melting and Pouring of Brass and Bronze .. 430
Melting, Down-Draft Furnace ..... 467
*Melting of Platinum, The ..... 433, 468
Melting Point Alloys, Notes on Low ..... 335
*Metal and Plating Industries in 1935, Improvements in the ..... 2
Metal Coatings, Measuring the Thickness of .. 135
*Metal Congress, National ..... 417
Metal Content of Plating Salts ..... 337
Metal Industries, A Calendar of Events of Importance to the ..... 17
*Metal Markets in 1935, The ..... 40
*Metal Products Manufacturing, Practical Time Study Methods in ..... 465
*Metal Rectifiers to Supply Current for Plating ..... 261
Metal, Slush Molding ..... 61
*Metal Spinning, The Art of ..... 285
Metals, Abrasives Used in the Polishing and Buffing of ..... 304
Metals and Alloys Applicable to the Chemical Industry, New ..... 383
*Metals and Their Structure ..... 264
*Metals Division Meeting, Institute of ..... 87
Metals, Effect of Surface Treatment on .... 100
Metals, Expansion of ..... 129
Metals, Exposure Tests of Plating on Non-Ferrous ..... 302
*Metals, Ingot ..... 2
Metals in Soils, Corrosion of ..... 482
Metals Meeting, British Institute of ..... 136
Metals Meeting, British Institute of ..... 385
*Metals, Secondary ..... 11
Metals, Specifications for ..... 167B
Metals, Specifications for ..... 177
Metals, Specifications for ..... 224
*Metals Week, National ..... 369
*Meter Method, Plating by the Amperehour .. 387
Method for Preparing Deliquescent Tin Dross Samples, A Suggested ..... 338
*Method of Measuring Electroplates, A New .. 258
*Method, Plating by the Amperehour Meter .. 387
*Methods for Determining the Thickness of Zinc Coatings ..... 173
*Mill Equipment, Brass ..... 3
Modern Finishes, The Comparative Evaluation of ..... 437
Molding Metal, Slush ..... 61
Molds, Casting in Plaster ..... 138
Motors Win Chromium Plating Patent Suit, General ..... 389

## N

*Name Plates, Aluminum ..... 327
*National Metal Congress ..... 417
*National Metals Week ..... 369
Navy Identification Discs, Army and ..... 181
Newark Platers Hold Open Meeting ..... 180
*Nickel ..... 6
Nickel Alloys, Plating Rhenium and Rhenium— 176
*Nickel and Its Non-Ferrous Alloys ..... 42
Nickel, Casting Pure ..... 257
Nickel, Casting Pure ..... 294
Nickel in Brass Foundry Practice ..... 330
*Nickel Plating Brought Up-to-Date ..... 298
Nickel Solution, Soft ..... 440
*Non-Ferrous Alloys, Nickel and Its ..... 42
Non-Ferrous Metals, Exposure Tests of Plating on ..... 302
Notes on Low Melting Point Alloys ..... 335

## O

Of Interest to the Veteran Brass Man ..... 297
Old Gold Solutions ..... 184

## P

Painting, Treatment of Galvanized Sheets for 215
Palladium Leaf on Vulcanite ..... 104
Patent Suit, General Motors Win Chromium Plating ..... 389
pH of Electroplating Solutions, The ..... 473
*Pistons, High Production Methods for Manufacturing Anodized Aluminum Alloy .... 103
Plant, Diesel Engine in the Plating ..... 344
Plaster Molds, Casting in ..... 138
*Plated Products for Quality, Testing ..... 222
Platers Hold Open Meeting, Newark .... 180
*Plates, Aluminum Name ..... 327
*Plating Brought Up-to-Date, Nickel ..... 298
*Plating by the Amperehour Meter Method .. 387
Plating, Fifty-Two Years of ..... 303
Plating, How to Estimate Job ..... 225
*Plating Industries in 1935, Improvements in the Metal and ..... 2
*Plating, Metal Rectifiers to Supply Current for ..... 261
Plating on Non-ferrous Metals, Exposure Tests of ..... 302
Plating Patent Suit, General Motors Win Chromium ..... 389
Plating Plant, The Diesel Engine in the .... 344
Plating Rhenium and Rhenium-Nickel Alloys 176
Plating Salts, Metal Content of ..... 337
*Plating, Silver ..... 10
Plating, Zinc ..... 99
Platinum, Etc., Heat Treatment of White Golds ..... 167B
*Platinum Group, The ..... 43
*Platinum, Melting of ..... 433, 468
Poisoning—Correction, Cyanide ..... 386
Poisoning, Cyanide ..... 346
Polishing and Buffing of Metals, Abrasives Used in the ..... 304
*Porcelain Enameling ..... 96
Pouring of Brass and Bronze, Melting and .. 430
Practical Brass Foundry Digest 23, 67, 109, 146, 189, 231, 269, 309, 352, 397, 444, 487
*Practical Time Study Methods in Metal Products Manufacturing ..... 465
Practice for Common Aluminum-Copper Alloys, Recommended ..... 15, 94, 127
Practice, Nickel in Brass Foundry ..... 330
*Practices for Sand Cast Magnesium Alloys, Recommended ..... 426, 471
Prizes for Exhibits ..... 264
Procedure, Burnishing ..... 301
Process of Electrogalvanizing Round Steel Wire, Bethlehem ..... 172
*Process, The Bek ..... 295
*Products for Quality, Testing Plated ..... 222
Progress, A Brass Foundryman's ..... 130, 291
Progress, Electroplating Research ..... 439
Proposed Revision QQ-B-691, Federal Specification for Bronze Castings ..... 288
Protective Value of Zinc and Cadmium Coatings on Steel ..... 129
Pure Nickel, Casting ..... 257
Pure Nickel Casting ..... 294
*Pyrometry in Smelting Works and Foundries, Usefulness of ..... 421

## Q

QQ-B-691 Federal Specification for Bronze Castings, Proposed Revision ..... 288
*Quality, Testing Plated Products for ..... 222

## R

Rapid Electrodeposition of Iron ..... 302
Recommended Practice for Common Aluminum-Copper Alloys ..... 15, 94, 127
*Recommended Practices for Sand Cast Magnesium Alloys ..... 426, 471
Recovering Copper and Zinc from Brass .... 440
Recovering Silver ..... 221
*Rectifiers to Supply Current for Plating, Metal ..... 261
Refining Cadmium ..... 216
Refining Silver Amalgam ..... 435
Removing Borax ..... 181
Research Progress, Electroplating ..... 439
Retinning, Cleaning Before ..... 216
Review of 1935—Prospects for 1936 ..... 18
Rhenium and Rhenium-Nickel Alloys, Plating 176
*Rolling, Brass ..... 3
*Round Wire, Electrogalvanizing ..... 168
*Rubber—a Vital Industrial Material ..... 477

## S

Salts, Metal Content of Plating ..... 337
Samples, A Suggested Method for Preparing Deliquescent Tin Dross ..... 338
*Sand Cast Magnesium Alloys, Recommended Practices for ..... 426, 471
Second Thoughts about Foundry Furnaces .. 131
*Secondary Metals ..... 11
Sheets for Painting, Treatment of Galvanized 215
Sheets, Treatment of Galvanized ..... 337
Shells, Cracking Brass ..... 59
Silver Amalgam, Refining ..... 435
*Silver, Gold and ..... 42
*Silver Plating ..... 10
Silver, Recovering ..... 221
Silver Solders are Used, When and How .. 420
Silver Solution ..... 482
Silver Solutions ..... 301
Silver to Protect Steels During Annealing .. 100
Silver to Silver Cyanide, From ..... 345
Slush Casting ..... 337

Slush Molding Metal ... 61
*Smelting Works and Foundries, Usefulness of Pyrometry in ... 421
Society for Testing Materials Meeting, American ... 254
*Society Holds Annual Meeting in Cleveland, American Electro-Platers' ... 207
Society Meeting, Electrochemical ... 178
Society Meeting, Electrochemical ... 436
Soft Nickel Solution ... 440
Soft Spots in Brass Castings, Hard and ... 335
Soils, Corrosion of Metals in ... 482
Solder, Corrosion of ... 104
*Soldering Conveyor, Automatic ... 293
Soldering Key Heads ... 253
Solders are Used, When and How Silver ... 420
Solution, Soft Nickel ... 440
Solutions, Old Gold ... 184
Solution, Silver ... 482
Solutions, Silver ... 301
Solutions, The pH of Electroplating ... 473
Specification for Bronze Castings, Proposed Revisions QQ-B-691 Federal ... 288
Specifications for Electrical Fittings ... 224
Specifications for Finishes ... 386
Specifications for Lead ... 224
Specifications for Metals ... 167B
Specifications for Metals ... 177
Specifications for Metals ... 224
Spinning Brass Tubes ... 225
*Spinning, The Art of Metal ... 285
Spots in Brass Castings, Hard and Soft ... 335
Spotted Brass ... 14
Standards for Brass Fittings for Tubes ... 221
Standards, New Alloys for Wire in Electrical Resistance ... 175
Steel, Bright Dip for ... 390
Steel, Protective Value of Zinc and Cadmium Coatings on ... 129
Steel Wire, Bethlehem Process of Electrogalvanizing Round ... 172
Steels During Annealing, Silver to Protect ... 100
Stereotype, Cleaning ... 425
Stripping Tin ... 135
*Structure, Metals and Their ... 264
*Study Methods in Metal Products Manufacturing, Practical Time ... 465
Suggested Method for Preparing Deliquescent Tin Dross Samples, A ... 338
Suit, General Motors Win Chromium Plating Patent ... 389
Surface Treatment on Metals, Effect of ... 100
Synthetic Enamels ... 60


## T


Test for Finishes, Accelerated Cold Cracking ... 214
Testing Materials Meeting, American Society for ... 254
Testing Materials Society Committee Meetings ... 133
*Testing Plated Products for Quality ... 222
Tests of Plating on Non-Ferrous Metals, Exposure ... 302
Thermal Expansion of Copper-Beryllium Alloys ... 260
Thickness of Metal Coatings, Measuring the ... 135
*Thickness of Zinc Coatings, Methods for Determining the ... 173
Tightening Inserts ... 341
*Time Study Methods in Metal Products Manufacturing, Practical ... 465
*Tin-Base Bearing Alloy, The Effect of the Addition of Lead on the Endurance Limit of a Certain ... 431
*Tin, Developments in ... 5
Tin Dross Samples, A Suggested Method for Preparing Deliquescent ... 338
*Tin in 1935 ... 40
*Tin, Lead and ... 5
Tin, Stripping ... 135
Tin Wash ... 343
Tinning Cast Iron ... 304
Tinning, Hot ... 384
Tinning Methods, Hot ... 102
Tinning of Brass, Hot ... 440
Tinning of Copper, Hot ... 438
Treatment, Aluminum Bronzes and Their Heat ... 250
Treatment of Galvanized Sheets ... 337
Treatment of Galvanized Sheets for Painting ... 215
Treatment of White Golds, Platinum, Etc., Heat ... 167B
*"Trouble-Shooting" on Electroplating Generators ... 339
Tubes, Spinning Brass ... 225
Tubes, Standards for Brass Fittings for ... 221


## U


*Up-to-Date, Nickel Plating Brought ... 298
*Usefulness of Pyrometry in Smelting Works and Foundries ... 421
*Uses of Zinc, The ... 4


## V


Veteran Brass Man, Of Interest to the ... 297
Vitreous Enamels, Hairlining of ... 391
Vulcanite, Palladium Leaf on ... 104


## W


Wash, Tin ... 343
*Week, National Metals ... 369
When and How Silver Solders are Used ... 420
White Golds, Platinum, Etc., Heat Treatment of ... 167B
Wire, Bethlehem Process of Electrogalvanizing Round Steel ... 172
*Wire, Electrogalvanizing Round ... 168
Wire in Electrical Resistance Standards, New Alloy for ... 175


## Z


*Zinc ... 41
Zinc and Cadmium Coatings on Steel, Protective Value of ... 129
Zinc Bath, Alloys in the ... 336
*Zinc Coatings, Methods for Determining the Thickness of ... 173
Zinc from Brass, Recovering Copper and ... 440
Zinc Plating ... 99
*Zinc, The Uses of ... 4


# AUTHORS

## B


Bartley, Jonathan. *A History of the American Crucible Business ... 47A
Bechtel, T. B. *Electric Annealing of Brass and Copper ... 12
Benford, F. G. *Beryllium-Copper-Cobalt Alloys ... 226
Blum, Dr. W. *A New Method of Measuring Electroplates ... 258
Blum, Dr. W. *Advances in Electroplating ... 8
Blum, Dr. W. Electroplating Research Progress ... 439
Brayton, G. A. Alloys in the Zinc Bath ... 336
Brenner, A. *A New Method of Measuring Electroplates ... 258


## C


C., T. H. Silver Solutions ... 301
Caddle, B. B. *Copper and Brass Manufacture ... 40
Chamberlain, T. H. Bright Dip for Steel ... 390
Chamberlain, T. H. Removing Borax ... 181
Chamberlain, T. H. Soft Nickel Solution ... 440
Chamberlain, T. H. Stripping Tin ... 135
Chamberlain, T. H. Tin Wash ... 343
Chen, K. K. Cyanide Poisoning ... 346
Christie, John L. *Brass Fabrication ... 4
Clamer, G. H. *Ingot Metals ... 2
Clark, D. R. *Brass Mill Equipment ... 3
Clowes, G. H. A. Cyanide Poisoning ... 346
Colby, S. K. *Aluminum ... 6
Coneen, J. F. Burnishing Procedure ... 301
Corson, M. G. Aluminum Bronzes and Their Heat Treatment ... 250
Corson, M. G. Second Thoughts About Foundry Furnaces ... 131
Curry, D. M. Casting Pure Nickel ... 257
Curry, D. M. Nickel in Brass Foundry Practice ... 330


## D


Dietle, C. E. The Diesel Engine in the Plating Plant ... 344
Donepp, H. M. Bearing Alloy ... 272
Doss, J. H. *Effect of Iron Impurities on the Annealing of High Brass ... 333


## E


Eichstaedt, T. C. Fifty-Two Years of Plating ... 303
Engelhard, Charles. *Platinum Group ... 43
Eyles, A. A New Process for Protection of Aluminum ... 193
Eyles, A. Notes on Low Melting Point Alloys ... 335


## F


Fink, Dr. Colin G. *Electrometallurgy ... 9
Francis, W. B. Army and Navy Identification Discs ... 181
Francis, W. B. Brass Machining ... 8
Francis, W. B. Brazing Fluxes ... 167A
Francis, W. B. Cracking Brass Shells ... 59
Francis, W. B. "Glass Finish" on Gears ... 432
Francis, W. B. Soldering Key Heads ... 253
Francis, W. B. Spinning Brass Tubes ... 225
Frankel, S. M. Refining Cadmium ... 216
Fraser, O. B. J. "Free" Machining Monel Metal ... 399
Fritz, Dr. H. E. *Use of Korolac as a Protective Coating on Electroplating Racks ... 26


## G


Gerline, Otto. A Brass Foundryman's Progress ... 130, 291
Gibson, W. A. *Effect of Iron Impurities on the Annealing of High Brass ... 333
Gieseke, Henry. The Electric Furnace ... 132
Graham, Dr. A. Kenneth. *Electroplating ... 9


## H


H., Jr., G. B. Cyanide Copper ... 287
H., Jr., G. B. Spotted Brass ... 14
Hall, Nathaniel. Metal Content of Plating Salts ... 337
Hardy, Charles W. *Automatic Lacquering, Enameling and Japanning ... 247
Hardy, Chas. W. *Automatic Soldering Conveyor ... 293
Hardy, Chas. W. Direct Labor Cost of Finishing Operations ... 342
Hardy, Chas. W. *Practical Time Study Methods in Metal Products Manufacturing ... 465
Hardy, C. W. Tightening Inserts ... 341
Harkins, Dr. H. H. *Rubber—A Vital Industrial Material ... 477
Hiers, G. O. Corrosion of Solder ... 104
Hiers, G. O. *Lead and Tin ... 5
Hitchcock, J. H. *Oil-Lubricated Sleeve Bearings for Roll Necks ... 235
H., Jr., G. B. Silver Solution ... 482
Hoff, C. M. Zinc Plating ... 99
Hogaboom, Jr., G. B. Cleaning Stereotype ... 425
Hogaboom, George B., *Electroplating ... 10
Hogaboom, G. Byron. Newark Platers Hold Open Meeting ... 180
Hogaboom, George B. *Nickel Plating Brought Up-to-Date ... 298
Hoke, C. M. *Jewelry Manufacture ... 7
Hoke, C. M. *The Melting of Platinum 433, 468
Huntley, F. J. *Electro-Platers' Convention in Cleveland ... 161
Huntley, F. J. *Foundrymen Will Meet in Detroit ... 123


## I


Imhoff, Wallace. Cleaning Before Retinning ... 216
Imhoff, Wallace. Hot Tinning ... 384
Imhoff, Wallace. Hot Tinning Methods ... 102
Imhoff, Wallace. Hot Tinning of Brass ... 440
Imhoff, Wallace. Hot Tinning of Copper ... 438
Imhoff, Wallace. Lead Coating Copper ... 292
Imhoff, Wallace. Tinning Cast Iron ... 304
Ingalls, W. R. *Zinc ... 41


## J


Jacobs, Fred B. *Art of Metal Spinning ... 285
Jewelry Metallurgist. From Silver to Silver Cyanide ... 345
Jewelry Metallurgist. Heat Treatment of White Golds, Platinum, Etc. ... 167B
Jewelry Metallurgist. Old Gold Solutions ... 184
Jewelry Metallurgist. Palladium Leaf on Vulcanite ... 104
Jewelry Metallurgist. Recovering Silver ... 221
Jewelry Metallurgist. Refining Silver Amalgam ... 435


## K


Kasey, J. B. A Suggested Method for Preparing Deliquescent Tin Dross Samples ... 338
Kenyon, John N. *The Effect of the Addition of Lead on the Endurance Limit of a Certain Tin-Base Bearing Alloy ... 431


## L


Leach, R. H. When and How Silver Solders Are Used ... 420
Leather, R. S. Abrasives Used in the Polishing and Buffing of Metals ... 304


## M


MacNaughtan, D. J. *Developments in Tin ... 5
Mantell, C. L. *Tin in 1935 ... 40
Martin, Ray C. Synthetic Enamels ... 60
Meier, Dr. H. F. Nucast 99% plus Nickel Anode ... 404
Merica, Dr. P. D. *Nickel ... 6
Mesle, F. C. *Silver Plating ... 10
Metallurgist B. Recovering Copper and Zinc from Brass ... 440
Meyer, Walter R. Barrel Burnishing ... 101
Meyer, Walter R. *Methods for Determining the Thickness of Zinc Coatings ... 173
Miskella, William J. *Porcelain Enameling ... 96


## N


Niemeyer, G. H. *Gold and Silver ... 42

## P

Pettis, W. J. *Brass Rolling ... 3
Pettis, W. J. Of Interest to the Veteran Brass Man ... 297
Pierce, W. M. *The Uses of Zinc ... 4

## R

Reardon, W. J. *Brass Foundry, The ... 2
Reardon, W. J. Bright Dip for Cast Bronze ... 392
Reardon, W. J. Casting Pure Nickel ... 294
Reardon, W. J. Down-Draft Furnace Melting ... 467
Reardon, W. J. Hard and Soft Spots in Brass Castings ... 335
Reardon, W. J. Manganese Bronze Castings ... 382
Reardon, W. J. Slush Casting ... 337
Reardon, W. J. Slush Molding Metal ... 61
Roon, Leo. The Comparative Evalulation of Modern Finishes ... 437
Rose, C. L. Cyanide Poisoning ... 346
Rosenberg, Dr. J. E. Hairlining of Vitreous Enamels ... 391

## S

Schueler, J. L. Treatment of Galvanized Sheets ... 337
Schueler, J. L. Treatment of Galvanized Sheets for Painting ... 215
Sievering, Jr., Philip. How to Estimate Job Plating ... 225
Sizelove, Oliver J. *Electroplating ... 10
Smart, A. *Metal Rectifiers to Supply Current for Plating ... 261
Springer, Dr. Richard The pH of Electroplating Solutions ... 473
Stoffel, L. L. *"Trouble-Shooting" on Electroplating Generators ... 339
Stanley, Robert C. *Nickel and Its Non-Ferrous Alloys ... 42
Stott, L. L. Beryllium Developments ... 7
St. John, H. M. Alloys Containing Cadmium ... 95
St. John, H. M. American Foundrymen's Association Convention in Detroit ... 217
St. John, H. M. Bearing Bronze ... 388
St. John, H. M. Casting in Plaster Molds ... 138
St. John, H. M. Expansion of Metals ... 129
St. John, H. M. *National Metal Congress ... 417
St. John, H. M. Practical Brass Foundry Digest ... 23, 67, 109, 146, 189, 231, 269, 309, 352, 397, 444, 487
St. John, H. M. *The Brass Foundry ... 2

## T

Thews, Edmund R. *Usefulness of Pyrometry in Smelting Works and Foundries ... 421
Thompson, Dr. G. W. *Lead and Tin ... 5
Tour, Sam. Magnesium Base Alloys ... 62
Tour, Sam. *Testing Plated Products for Quality ... 222

## W

Weisberg, Dr. Louis. *The Bek Process ... 295
Weisselberg, Arnold. *Electrogalvanizing Round Wire ... 168
Wernick, S. *Electroplating in Great Britain ... 11
Wilson, Robert W. *Plating by the Ampere-hour Meter Method ... 387
Wise, M. M. *The Jobbing Electroplating Industry ... 10
Work, Dr. H. K. *Aluminum Name Plates ... 327
Wormser, F. E. *Lead ... 5
Wright, Thomas A. *Secondary Metals ... 11

## Y

Young, Dr. C. B. F. Plating Rhenium and Rhenium-Nickel Alloys ... 176


# SHOP PROBLEMS


## A

Acid Copper ... 307
Alloy, Pattern ... 230
Aluminum, Black on ... 229
Aluminum-Chrome on Grilles-Spacing Buffs, Cleaning ... 144
Analyses, Solution ... 486
Analysis, Copper ... 350
Analysis, Nickel ... 485
Analysis, Nickel Solution ... 188
Anodes, Crumbling ... 65
Antimonial Lead, Drossy ... 230
Antimonial Lead, Pouring ... 145

## B

Baby Shoes, Musical Instruments and ... 442
Bag Frames, Copper and Brass on ... 396
Bases, Plating on Iron ... 268
Basket or Rack for Gold, Plating ... 443
Black Nickel, Oxidizing, Bronzing and ... 66
Black on Aluminum ... 229
Black on Cast Iron, Chemical ... 107
Black on Name Plates ... 350
Blades, Etching Shear ... 442
Bluing Stoves ... 107
Brass, Bright Dip for ... 350
Brass, Brown on ... 21
Brass Castings, Oxidized ... 308
Brass, Green-Brown on ... 268
Brass on Bag Frames, Copper and ... 396
Brass Plate, Streaky ... 486
Brass, Red-Brown on ... 443
Brass, Red Surface on Cast ... 145
Bright Dip for Brass ... 350
Bright, Gold, Yellow ... 145
Bright Tin Solution ... 229
Brightening Tin Plates ... 229
Brittle, Streaky Nickel ... 65
Bronze, Core Wash for ... 308
Bronze Liners, Casting ... 307
Bronze, Oxidizing Ornamental ... 188
Bronze, Removing Fire Scale from ... 145
Bronze, Smoking Molds for ... 145
Bronze Tablets, Protecting and Coloring ... 486
Bronze, White ... 308
Bronzing and Black Nickel, Oxidizing ... 66
Brown on Brass ... 21
Brown on Brass, Green- ... 268
Brown on Brass, Red- ... 443
Buffing Sterling Silver ... 187
Buffs, Cleaning Aluminum-Chrome on Grilles-Spacing ... 144
Buttons, Gold on ... 22

## C

Cadmium on Steel Rings ... 485
Cadmium Solution, Iron on ... 22
Cast Brass, Red Surface on ... 145
Cast Iron, Chemical Black on ... 107
Cast Iron, Copper ... 267
Casting Bronze Liners ... 307
Casting, Slush ... 268
Castings, Discolored Die ... 229
Castings, Gassy ... 144
Castings, Oxidized Brass ... 308
Castings, Plating on Porous ... 443
Chains, Finishing Steel Handbag ... 108
Chemical Black on Cast Iron ... 107
Chrome on Grilles—Spacing Buffs—Cleaning Aluminum- ... 144
Chromium Plating Practice ... 307
Chromium, Stripping Nickel and ... 230
Cleaning Aluminum-Chrome on Grilles—Spacing Buffs ... 144
Cold Gold Solution ... 107
Cold Rolled Steel, Nickel for ... 144
Coloring Bronze Tablets, Protecting and ... 486
Consumption, Nickel ... 188
Contaminated Nickel Solution ... 267
Contaminated Silver Solution ... 267
Copper, Acid ... 307
Copper Analysis ... 350
Copper and Brass on Bag Frames ... 396
Copper and Nickel Solutions ... 267
Copper, Cyanide ... 187
Copper Dip ... 187
Copper in Cast Iron ... 267
Copper in Nickel Solution ... 351
Copper or Zinc, Etching ... 108
Copper, Pitted ... 108
Copper Solution, Slow ... 396
Copper Strike to Prevent Peeling ... 21
Core Wash for Bronze ... 308
Cream of Tartar Silver ... 21
Crumbling Anodes ... 65
Cyanide Copper ... 187

## D

Dark Nickel, Hard ... 66
Dark Nickel Plate ... 22
Dark Nickel Plate ... 395
Deposit, Insufficient Nickel ... 187
Die Castings, Discolored ... 229
Dip, Copper ... 187
Dip for Brass, Bright ... 350
Dip Silver ... 22
Discolored Die Castings ... 229
Dross, Refractory for Smelting ... 268
Drossy Antimonial Lead ... 230

## E

Etching Copper or Zinc ... 108
Etching Shear Blades ... 442
Etching, Stainless Steel ... 66

## F

Fine Dull Matte Finish ... 108
Finish, Fine Dull Matte ... 108
Finishing, Spray ... 66
Finishing Steel Handbag Chains ... 108
Finishing Sterling Silver ... 65
Fire Scale from Bronze, Removing ... 145
Frames, Copper and Brass on Bag ... 396

## G

Gassy Castings ... 144
Gold on Buttons ... 22
Gold on Safety Pins ... 395
Gold, Plating Basket or Rack for ... 443
Gold Solution ... 187
Gold Solution, Cold ... 107
Gold Solution, Rose ... 66
Gold, Yellow Bright ... 145
Green-Brown on Brass ... 268
Grilles—Spacing Buffs, Cleaning Aluminum-Chrome on ... 144
Gun Metal Solution ... 395

## H

Handbag Chains, Finishing Steel ... 108
Hard, Dark Nickel ... 66

## I

Instruments and Baby Shoes, Musical ... 442
Insufficient Nickel Deposit ... 187
Iron Bases, Plating on ... 268
Iron, Chemical Black on Cast ... 107
Iron, Copper in Cast ... 267
Iron on Cadmium Solution ... 22

## L

Lead, Drossy Antimonial ... 230
Lead, Pouring Antimonial ... 145
Lead Sweat, Preventing ... 145
Liners, Casting Bronze ... 307

## M

Matte Finish, Fine Dull ... 108
Metal, Plating Over Type ... 188
Metal Solution, Gun ... 395
Molds for Bronze, Smoking ... 145
Musical Instruments and Baby Shoes ... 442

## N

Name Plates, Black on ... 350
Nickel Analysis ... 485
Nickel and Chromium, Stripping ... 230
Nickel and Silver-Nickel ... 442
Nickel and Silver Solution ... 396
Nickel and Silver Troubles ... 443
Nickel, Brittle, Streaky ... 65
Nickel Consumption ... 188
Nickel Deposit, Insufficient ... 187
Nickel for Cold Rolled Steel ... 144
Nickel, Hard, Dark ... 66
Nickel, Oxidizing, Bronzing and Black ... 66
Nickel, Peeling ... 308
Nickel, Pitted ... 188
Nickel Plate, Dark ... 22
Nickel Plate, Dark ... 395
Nickel, Rough ... 145
Nickel Solution ... 66
Nickel Solution Analysis ... 188
Nickel Solution, Contaminated ... 267
Nickel Solution, Copper in ... 351
Nickel Solution for Stereotypes ... 485
Nickel Solutions, Copper and ... 267
Nickel, Stained ... 486

## O

Ornamental Bronze, Oxidizing ... 188
Oxidized Brass Castings ... 308
Oxidized Silver ... 308
Oxidizing, Bronzing and Black Nickel ... 66
Oxidizing Ornamental Bronze ... 188

## P

Paste, Silver ... 268
Pattern Alloy ... 230
Peeling, Copper Strike to Prevent ... 21
Peeling Nickel ... 308
Pins, Gold on Safety ... 395
Pitted Copper ... 108
Pitted Nickel ... 188
Pitted Silver ... 22
Plate, Brightening Tin ... 229
Plate, Dark Nickel ... 395
Plates, Black on Name ... 350
Plate, Streaky Brass ... 486
Plating Basket or Rack for Gold ... 443
Plating on Iron Bases ... 268
Plating on Porous Castings ... 443
Plating Over Type Metal ... 188
Plating Practice, Chromium ... 307
Polish, Silver ... 108
Polishing Stainless Steel ... 230
Porous Castings, Plating on ... 443
Pouring Antimonial Lead ... 145
Preventing Lead Sweat ... 145

Preventive, Rust ..... 22
Protecting and Coloring Bronze Tablets .. 486

R

Rack for Gold, Plating Basket or ..... 443
Red-Brown on Brass ..... 443
Red Surface on Cast Brass ..... 145
Refining Scrap Zinc ..... 351
Refractory for Smelting Dross ..... 268
Removing Fire Scale from Bonze ..... 145
Rings, Cadmium on Steel ..... 485
Rolled Steel, Nickel for Cold ..... 144
Rose Gold Solution ..... 66
Rough Nickel ..... 145
Rust Preventive ..... 22

S

Safety Pins, Gold on ..... 395
Saylor-Beall Mfg. Co., Detroit, Mich., *New Spray Gun ..... 490
Scale, Silver Solution—Silver ..... 230
Scrap Zinc, Refining ..... 351
Shear Blades, Etching ..... 442
Shoes, Musical Instruments and Baby ..... 442
Silver, Buffing Sterling ..... 187
Silver Cream of Tartar ..... 21
Silver, Dip ..... 22
Silver, Finishing Sterling ..... 65
Silver-Nickel, Nickel and ..... 442
Silver, Oxidized ..... 308
Silver Paste ..... 268
Silver, Pitted ..... 22
Silver Polish ..... 108
Silver Solution ..... 396
Silver Solution, Contaminated ..... 267
Silver Solution, Nickel and ..... 396
Silver Solution—Silver Scale ..... 230
Silver, Tarnished ..... 268
Silver Troubles, Nickel and ..... 443
Slow Copper Solution ..... 396
Slush Casting ..... 268
Smelting Dross, Refractory for ..... 268
Smoking Molds for Bronze ..... 145
Solution Analyses ..... 486
Solution, Bright Tin ..... 229
Solution, Cold Gold ..... 107
Solution, Contaminated Nickel ..... 267
Solution, Contaminated Silver ..... 267
Solution, Copper in Nickel ..... 351
Solution for Stereotypes, Nickel ..... 485
Solution, Gold ..... 187
Solution, Gun Metal ..... 395
Solution, Nickel ..... 66
Solution, Nickel and Silver ..... 396
Solution, Rose Gold ..... 66
Solution, Silver ..... 396
Solution—Silver Scale, Silver ..... 230
Solution, Slow Copper ..... 396
Solutions, Copper and Nickel ..... 267
Spacing Buffs, Cleaning Aluminum-Chrome on Grilles- ..... 144
Spray Finishing ..... 66
Stained Nickel ..... 486
Stainless Steel Etching ..... 66
Stainless Steel, Polishing ..... 230
Steel Etching, Stainless ..... 66
Steel Handbag Chains, Finishing ..... 108
Steel, Nickel for Cold Rolled ..... 144
Steel, Polishing Stainless ..... 230
Steel Rings, Cadmium on ..... 485
Stereotypes, Nickel Solution for ..... 485
Sterling Silver, Buffing ..... 187
Sterling Silver, Finishing ..... 65
Stoves, Bluing ..... 107
Streaky Brass Plate ..... 486
Streaky Nickel, Brittle ..... 65
Stripping Nickel and Chromium ..... 230
Surface on Cast Brass, Red ..... 145
Sweat, Preventing Lead ..... 145

T

Tablets, Protecting and Coloring Bronze .. 486
Tarnished Silver ..... 268
Tin Plate, Brightening ..... 229
Tin Solution, Bright ..... 229
Troubles, Nickel and Silver ..... 443
Type Metal, Plating Over ..... 188

W

Wash for Bronze, Core ..... 308
White Bronze ..... 308

Y

Yellow, Bright Gold ..... 145

Z

Zinc, Etching Copper or ..... 108
Zinc, Refining Scrap ..... 351


# EQUIPMENT


A

*15" Disc Grinder ..... 402
99% plus Nickel Anode, The Nucast ..... 404
*Abrasive Cut-Off Machine ..... 111
Acid-Alkalimeter ..... 272
*Acid Content in Nickel Solutions, Analytical Set for Boric ..... 447
*Acid Handling Equipment ..... 354
Acid Proof Cement ..... 356
Acid Resisting Floors ..... 495
Acme Colored Superstrip Strip Steel ..... 449
*Agents, New Corrosion Resistant Specialties for Use in Plants Handling Corrosive ..... 490
Air Separator, Centrifugal ..... 315
*Ajax-Hultgren Heat Treating Furnace ..... 311
Alcohol, Synthetic Enamel Resists Heat and ..... 233
Alkalimeter, Acid ..... 272
Alloy, Bearing ..... 272
Alloy, Copper Base ..... 72
*Alloy, Copper Hot Water ..... 401
*Alloy for Making Molds for Plastics, New .. 69
*Alloy Goggles, Magnesium ..... 491
Alloy, New Aluminum ..... 192
Alloy, New Brazing ..... 404
Alloy, New Copper ..... 401
Alloy Sizes, New Low Temperature Brazing 490
Alrose Wite-Brass Plate ..... 488
Aluminum, A New Process for Protection of ..... 193
Aluminum Alloy, New ..... 192
Aluminum, Cast Iron, Etc., Flux for Soldering 451
Aluminum, Coating Steel with ..... 24
*Aluminum Melting Furnace ..... 356
Aluminum Paint, Priming Vehicle for ..... 449
*Aluminum Piston, Bohn Autothermic ..... 491
Aluminum Ware, Heat Resisting Lacquer for 271
Alzak Reflector ..... 356B
*American Wheelabrator Multi-Rotary Table .. 110
*Analytical Set for Boric Acid Content in Nickel Solutions ..... 447
*Anode, New Chromium Plating ..... 489
Anode, The Nucast 99% plus Nickel ..... 404
Anodes, Chromium Plating ..... 192
*Apex Slide Rule ..... 234
Apparatus, New Electrolytic ..... 317
*Approved Respirators ..... 452
*Automatic Die Casting Machine ..... 314
*Automatic Die Casting Machine, Large .... 356A
*Automatic Electric Salt Bath Installation .. 447
*Automatic Glue Heater ..... 313
*Automatic Polishing and Buffing Machine .. 446
*Automatic Polishing and Buffing Machine, Large Production ..... 403
*Automatic Pressure Compensator ..... 271
*Automatic Rotary Polisher and Buffer .... 194
*Automatic Station Type Descaling Machine, Full ..... 489
*Autothermic Aluminum Piston, Bohn ..... 491

B

Back, Sheet Metal on Non-Metal ..... 234
*Barrel, Midget Plating ..... 270
Barrel Plating Bright Zinc ..... 446
*Barrels, Mechanical Plating ..... 25
*Barrels, Tumbling and Burnishing ..... 233
Bases for Metal Cutting Oils, New Polymerized Wax Sulphur ..... 312
Basic Chemical for Steel Cleaning, New .... 403
*Bath Installation, Automatic Electric Salt .. 447
Bath Salts for Non-Ferrous Metals ..... 495
*Baths, Electrified Solder ..... 315
Bearing Alloy ..... 272
*Bearings for Roll Necks, Oil-Lubricated Sleeve ..... 235
*Belt Grinder and Polisher ..... 401
*Belt Grinder and Polisher ..... 446
*Belt in Two New Styles, Compensated .... 489
*Bench Gas Furnaces ..... 449
*Bench Grinder, New ..... 356
Bitumen, Rubber and ..... 356
Bituminous Metal Primer ..... 316
Black or White Coatings ..... 356B
Blue on Steel ..... 312
*Bohn Autothermic Aluminum Piston ..... 491
*Bonderizing Process, Zinc ..... 353
*Boric Acid Content in Nickel Solutions, Analytical Set for ..... 447
Brass Die Casting Machine ..... 316
Brazing Alloy, New ..... 404
Brazing Alloy Sizes, New Low Temperature 490
Breaker, Joint ..... 356A
Bright Nickel and Chromium Solutions .... 28
Bright Nickel Process, New ..... 27
Bright Zinc, Barrel Plating ..... 446
Bright Zinc Deposit ..... 233
Bright Zinc Deposit ..... 494
Bright Zinc Plating ..... 28
"Brush Charting Service" for Motor Maintenance, New ..... 314
Brush, The Lea String ..... 404
*Buffer, Automatic Rotary Polisher and .... 194
Buffers, Grinders and ..... 71
Buffing and Polishing Compounds, Removal of 190
*Buffing and Polishing Machine, Selective Speed ..... 234
*Buffing and Polishing Machine, Standard Independent Spindle ..... 271
Buffing Compositions ..... 191
Buffing Compositions, New Line of ..... 488
Buffing Compounds, Testing ..... 445
Buffing, Enamel Standard Chrome Plating and ..... 355
*Buffing Lathes, Polishing and ..... 28
*Buffing Machine, Automatic Polishing and 446
*Buffing Machine, Large Production Automatic Polishing and ..... 403
*Buffing Machine, New Polishing & ..... 272
*Buffing Machine, Sheet ..... 316
*Buff, Mirror ..... 489
Buffs, Re-Made ..... 70
*Burnishing Barrels, Tumbling and ..... 233

C

*Capstan Head Thermometer ..... 491
Carboy Rocker, Safety ..... 74
*Card for Setting Up Polishing Wheels, Handy Direction Wall ..... 313
Cast Iron, Etc., Flux for Soldering Aluminum 451
*Castable Refractory ..... 402
*Casting Machine, Large Automatic Die .... 356A
Castings, Enamel Finish for Die ..... 311
Cathode Rod, New ..... 71
Cellulose Ester Lacquers, New Resins for .. 312
Cement, Acid Proof ..... 356
Cement, Flexible Polishing Wheel ..... 447
Centrifugal Air Separator ..... 315
"Charting Service," for Motor Maintenance, New "Brush" ..... 314
Chemical for Steel Cleaning, New Basic .... 403
Chrome Plating and Buffing, Enamel Stands 355
*Chromium Plating Anode, New ..... 489
Chromium Plating Anodes ..... 192
Chromium Plating Process, New ..... 356B
Chromium Solution, New ..... 232
Chromium Solutions, Bright Nickel and .... 28
Chromizing ..... 233
Chromometer, Photo- ..... 272
Cleaner, Household ..... 492
Cleaner, Metal ..... 312
*Cleaning Machine, Midget Metal ..... 313
Cleaning, New Basic Chemical for Steel .... 403
Coating for Metals ..... 315
Coating for Zinc, Protective ..... 273
Coating, Metal Radio Tube ..... 25
Coating, Metallic ..... 192
Coating, New Metal ..... 194
*Coating on Electroplating Racks, Use of Korolac as a Protective ..... 26
Coating, Protective Foundry ..... 355
Coating Steel with Aluminum ..... 24
*Coating, Temporary Protective ..... 448
Coatings, Black or White ..... 356B
*Collector, Dust ..... 402
*Collector, Dustube ..... 70
*Collectors, Multi-Wash Dust ..... 73
Colored Superstrip Strip Steel, Acme ..... 449
*Combination Pyrometer ..... 148
Comparator, Rhodium ..... 271
*Compensated Belt in Two New Styles .... 489
*Compensator, Automatic Pressure ..... 271
Compositions, Buffing ..... 191
Compositions, New Line of Buffing ..... 488
Compounds, Removal of Buffing and Polishing 190
Compounds, Testing Buffing ..... 445
Control, Plating Solution ..... 355
*Control, Remove Valve ..... 147
*Control, Temperature ..... 72
*Controlling Pyrometer, Recording ..... 401
*Conveyorized, Three-Dip Detrex Degreaser . 449
Copper Alloy, New ..... 401
Copper Base Alloy ..... 72
*Copper Hot Water Alloy ..... 401
Copper Plate Solution ..... 356A
*Corrosion Inhibitors ..... 450
Corrosion, New Enamels to Protect Iron and Steel from ..... 355
*Corrosion Resistant Specialties for Use in Plants Handling Corrosive Agents, New .. 490
Crystal Lacquers, Modern ..... 495
Corrosive Agents, New Corrosion Resistant Specialties for Use in Handling ..... 490
*Cut-Off Machine, Abrasive ..... 111

D

*Deformation Tester, Sand ..... 315
*Degreaser, Conveyorized Three-Dip Detrex . 449
*Degreaser, Special Vapor-Spray-Vapor Detrex 492
*Degreaser, The Hydro- ..... 451
*Degreasing Installation, Large ..... 314
*Degreasing Machine, Solvent ..... 354
*Dentist's Electroforming Machine ..... 406
Deposit, Bright Zinc ..... 233
Deposit Bright Zinc ..... 494
*Descaling Machine, Full Automatic Station Type ..... 489
*Descaling Service, Improved Spray Nozzles for ..... 448
*Detrex Degreaser, Conveyorized, Three-Dip 449
*Detrex Degreaser, Special Vapor-Spray-Vapor 492
*Device, Novel Safety ..... 406
*Dewatering Tanks ..... 452
*Die Casting Machine, Automatic ..... 314
Die Casting Machine, Brass ..... 316
*Die Casting Machine, Large Automatic .... 356A
Die Castings, Enamel Finish for ..... 311
Dipping Tanks, Korolac ..... 191
*Disc Grinder, 15" ..... 402
*Displacement Pump, Small Capacity Positive 72
Drawing Operation, Synthetic Finish Unmarred by ..... 148
*Dressing Machine, Wheel ..... 270
*Duriron Heat Exchanger ..... 193

*Dust Collector ..... 402
*Dust Collectors, Multi-Wash ..... 73
*Dustube Collector ..... 70

## E

*Electric Furnace, New High Temperature .. 400
Electric Furnace, Resistor Type Rocking .. 70
*Electric Furnaces ..... 488
Electric Hand Magnet ..... 316
*Electric Machine for Sanding and Finishing, New ..... 448
*Electric Salt Bath Installation, Automatic .. 447
*Electric Sander ..... 493
*Electrified Solder Baths ..... 315
*Electrocoated Sandpaper ..... 192
*Electroforming Machine, Dentist's ..... 406
Electrolytic Apparatus, New ..... 317
*Electroplating Racks, Use of Korolac as a Protective Coating on ..... 26
Emulsion, New Solvent ..... 356A
Enamel Finish for Die Castings ..... 311
*Enamel Laboratory, Modern Porcelain .... 149
Enamel Resists Heat and Alcohol, Synthetic 233
Enamel Stands Chrome Plating and Buffing .. 355
*Enameling, Furnace for Porcelain ..... 450
Enamels to Protect Iron and Steel from Corrosion, New ..... 355
*Equipment, Acid Handling ..... 354
*Equipment for Use with Synthetic Materials, Spray ..... 406
Ester Lacquers, New Resins for Cellulose .. 312
Etching Machine ..... 492
*Exchange, Duriron Heat ..... 193
*Extractor, Oil ..... 404
Extrusion Process, New ..... 235

## F

*Facing Machine, Gate Valve Body and Wedge ..... 356A
*Fast Production Spray Gun ..... 191
*Featherweight Foundry Flask ..... 24
Filter Press, New ..... 192
Finish for Die Castings, Enamel ..... 311
Finish Unmarred by Drawing Operation, Synthetic ..... 148
Finishes, Special Metal ..... 356
*Finishing, New Electric Machine for Sanding and ..... 448
*Finishing Wheel, New ..... 490
*Flask, Featherweight Foundry ..... 24
*Flexible Furnace, More ..... 446
Flexible Polishing Wheel Cement ..... 447
*Flexible Rubber Latex Pail ..... 493
*Flexible Shafting, New ..... 355
Floors, Acid Resisting ..... 495
*Fluid Strainer, Spray Gun ..... 233
Flux for Soldering Aluminum, Cast Iron, Etc. ..... 451
Flux, New ..... 494
Flux, Soldering ..... 270
*Full Automatic Station Type Descaling Machine ..... 489
Foundry Coating, Protective ..... 355
*Foundry Flask, Featherweight ..... 24
*Foundry Show, Wheelabrator Line Exhibited at ..... 192
*Foundry Supply House Uses Novel Sales Stimulation ..... 148
"Free" Machining Monel Metal ..... 399
*Furnace, Ajax-Hultgren Heat Treating .... 311
*Furnace, Aluminum Melting ..... 356
*Furnace for Porcelain Enameling ..... 450
*Furnace, More Flexible ..... 446
*Furnace, New High Temperature Electric .. 400
Furnace, Resistor Type Rocking Electric .... 70
*Furnaces, Bench Gas ..... 449
*Furnaces, Electric ..... 488

## G

Galvanized Iron and Also for Non-Spangled Galvanized Iron, Primers for ..... 405
*Gas Furnaces, Bench ..... 449
*Gate Valve Body and Wedge Facing Machine ..... 356A
*Glue Heater, Automatic ..... 313
*Goggle, New Safety ..... 493
*Goggles, Magnesium Alloy ..... 491
*Grinder, 15" Disc ..... 402
*Grinder and Polisher, Belt ..... 401
*Grinder and Polisher, Belt ..... 446
*Grinder, New Bench ..... 356
*Grinder, New Lathe ..... 400
*Grinder, Portable Motor Driven Worm Thread ..... 72
Grinders and Buffers ..... 71
*Grinders, Snagging ..... 494
*Grinding Machine, New ..... 445
Grinding Oil and Paste, Soluble ..... 314
*Gun, Fast Production Spray ..... 191
*Gun Fluid Strainer, Spray ..... 233
*Gun, New Spray ..... 490
*Gun, Solder Spray ..... 450
*Gyratory Screen Unit for Sandslingers .... 111

## H

Hand Magnet, Electric ..... 316
*Handling Equipment, Acid ..... 354
*Handy Direction Wall Card for Setting Up Polishing Wheels ..... 313
*Head Thermometer, Capstan ..... 491
Heat and Alcohol, Synthetic Enamel Resists 233
*Heat Exchanger, Duriron ..... 193
Heat Resisting Lacquer for Aluminum Ware 271
Heat Resisting Vehicle ..... 403
*Heat Treating Furnace, Ajax-Hultgren .... 311
*Heater, Automatic Glue ..... 313
*High Temperature Electric Furnace, New .. 400
Holder, Markal ..... 313
*Hood, Respirator ..... 492
*Hot Water Alloy, Copper ..... 401
Household Cleaner ..... 492
*House Uses Novel Sales Stimulation, Foundry Supply ..... 148
*Hultgren Heat Treating Furnace, Ajax- .... 311
*Hydro-Degreaser, The ..... 451

## I

Improved Liquid Sulphur ..... 447
*Improved Readability of Thermometers .... 405
*Improved Sander ..... 191
*Improved Spray Nozzles for Descaling Service ..... 448
Improvements in Refractories ..... 399
Inhibitive Primer, Rust ..... 316
Inhibitive, Rust ..... 494
*Inhibitors, Corrosion ..... 450
*Installation, Automatic Electric Salt Bath .. 447
*Installation, Large Degreasing ..... 314
Institute, Scientific Research ..... 451
Insulated Oven Panel ..... 316
*Insulated Plating Racks, Special ..... 402
Insulation, A Plastic ..... 70
"Invisible Ray" Welding ..... 355
Iron and Also for Non-Spangled Galvanized, Iron, Primers for Galvanized ..... 405
Iron and Steel from Corrosion, New Enamels to Protect ..... 355
Iron, Etc., Flux for Soldering Aluminum, Cast ..... 451

## J

Jetal Process, The ..... 112
Jetal Process, The ..... 148
Joint Breaker ..... 356A
*Joint, New Type ..... 451

## K

*Korolac as a Protective Coating on Electroplating Racks, Use of ..... 26
Korolac Dipping Tanks ..... 191
*Koroseal Tank Linings ..... 493

## L

Laboratory Mixer ..... 74
*Laboratory, Modern Porcelain Enamel .... 149
Lacquer for Aluminum Ware, Heat Resisting 271
Lacquer, Modern Crystal ..... 495
Lacquer, Paper ..... 493
Lacquers, Metallic ..... 111
Lacquers, New Resins for Cellulose Ester .. 312
*Large Automatic Die Casting Machine .... 356A
*Large Degreasing Installation ..... 314
*Large Production Automatic Polishing and Buffing Machine ..... 403
Largest Plating Tank, World's ..... 73
*Largest Vulcanizer, World's ..... 400
*Lathe Grinder, New ..... 400
*Lathe, Variable Speed ..... 147
*Lathes, Polishing and Buffing ..... 28
*Latex Pail, Flexible Rubber ..... 493
Lea String Brush, The ..... 404
Line of Buffing Compositions, New ..... 488
*Linings, Koroseal Tank ..... 493
Liquid Sulphur, Improved ..... 447
Low Temperature Brazing Alloy Sizes, New 490

## M

*Machine, Abrasive Cut-Off ..... 111
*Machine, Automatic Die Casting ..... 314
*Machine, Automatic Polishing and Buffing .. 446
Machine, Brass Die Casting ..... 316
*Machine, Dentist's Electroforming ..... 406
*Machine for Sanding and Finishing, New Electric ..... 448
*Machine, Gate Valve Body and Wedge Facing ..... 356A
Machine, Etching ..... 492
*Machine, Full Automatic Station Type Descaling ..... 489
*Machine, Large Automatic Die Casting .... 356A
*Machine, Large Production Automatic Polishing and Buffing ..... 403
*Machine, Metal Spray ..... 73
*Machine, Midget Metal Cleaning ..... 313
*Machine, New Grinding ..... 445
*Machine, New Plating ..... 190
*Machine, New Polishing & Buffing ..... 272
*Machine, Rod Straightener and Shear .... 494
*Machine, Selective Speed Buffing and Polishing ..... 234
*Machine, Semi-Automatic Plating ..... 25
*Machine, Sheet Buffing ..... 316
*Machine, Solvent Degreasing ..... 354
*Machine, Standard Independent Spindle Buffing & Polishing ..... 271
Machine, Tin Plating ..... 451
*Machine, Wheel Dressing ..... 270
Machining Monel Metal, "Free" ..... 399
*Magnesium Alloy Goggles ..... 491
Magnet, Electric Hand ..... 316
Magnetic Pulley ..... 356
Maintenance, New "Brush Charting Service" for Motor ..... 314
Markal Holder ..... 313
*Materials, Spray Equipment for Use with Synthetic ..... 406
Measuring Microscope, Spectrum ..... 71
*Mechanical Plating Barrels ..... 25
*Melting Furnace, Aluminum ..... 356
Metal Cleaner ..... 312
*Metal Cleaning Machine, Midget ..... 313
Metal Coating, New ..... 194
Metal Cutting Oils, New Polymerized Wax Sulphur Bases for ..... 312
Metal Finishes, Special ..... 356
Metal, "Free" Machining Monel ..... 399
Metal on Non-Metal Back, Sheet ..... 234
Metal Plates, Precious ..... 69
Metal Primer, Bituminous ..... 316
Metal Radio Tube Coating ..... 25
Metal Rebuilding Process ..... 447
Metals, Bath Salts for Non-Ferrous ..... 495
*Metal Spray Machine ..... 73
Metallic Coating ..... 192
Metallic Lacquers ..... 111
*Metallographic Polisher ..... 71
Metals, Coating for ..... 315
Microscopic, Spectrum Measuring ..... 71
*Midget Metal Cleaning Machine ..... 313
*Midget Plating Barrel ..... 270
*Mirror Buff ..... 489
Mixer, Laboratory ..... 74
Modern Crystal Lacquer ..... 495
*Modern Porcelain Enamel Laboratory .... 149
*Molds for Plastics, New Alloy for Making 69
Monel Metal, "Free" Machining ..... 399
*More Flexible Furnace ..... 446
Motor Maintenance, New "Brush Charting Service" for ..... 314
Mullite Refractories ..... 148
*Multi-Rotary Table, American Wheelabrator 110
*Multi-Wash Dust Collectors ..... 73

## N

*Necks, Oil-Lubricated Sleeve Bearings for Roll ..... 235
New Flux ..... 494
Nickel and Chromium Solutions, Bright .... 28
Nickel Anode, The Nucast 99% plus .... 404
Nickel Pitting, Preventive ..... 272
Nickel Process, New Bright ..... 27
*Nickel Solutions, Analytical Set for Boric Acid Content in ..... 447
Non-Ferrous Metals, Bath Salts for ..... 495
Non-Metal Back, Sheet Metal on ..... 234
Non-Spangled Galvanized Iron, Primers for Galvanized Iron and Also for ..... 405
*Novel Safety Device ..... 406
*Novel Sales Stimulation, Foundry Supply House Uses ..... 148
*Nozzles for Descaling Service, Improved Spray ..... 448
Nucast 99% plus Nickel Anode, The ..... 404

## O

Oil and Paste, Soluble Grinding ..... 314
*Oil Extractor ..... 404
*Oil-Lubricated Sleeve Bearings for Roll Necks ..... 235
Oils, New Polymerized Wax Sulphur Bases for Metal Cutting ..... 312
*Optical Pyrometer ..... 111
Oven Panel, Insulated ..... 316

## P

*Pail, Flexible Rubber Latex ..... 493
Paint, Priming Vehicle for Aluminum .... 449
Panel, Insulated Oven ..... 316
Paper Lacquer ..... 493
Paste, Soluble Grinding Oil and ..... 314
Photo-Chromometer ..... 272
*Piston, Bohn Autothermic Aluminum ..... 491
Pitting, Preventive for Nickel ..... 272
Plants Handling Corrosive Agents, New .. 490
*Plants Handling Corrosive Agents, New Corrosion Resistant Specialties for Use in .. 490
Plastic Insulation, A ..... 70
Plastic Refractories, New ..... 400
*Plastics, New Alloy for Making Molds for 69
Plate, Alrose Wite-Brass ..... 488
Plate Solution, Copper ..... 356A
Plates, Precious Metal ..... 69
Plating and Buffing, Enamel Stands Chrome 355
*Plating Anode, New Chromium ..... 489
Plating Anodes, Chromium ..... 192

*Plating Barrel, Midget ... 270
*Plating Barrels, Mechanical ... 25
Plating, Bright Zinc ... 28
Plating Bright Zinc, Barrel ... 446
*Plating Machine, New ... 190
*Plating Machine, Semi-Automatic ... 25
Plating Machine, Tin ... 451
Plating Process, New Chromium ... 356B
*Plating Rack, New ... 194
*Plating Racks, Special Insulated ... 402
Plating Solution Control ... 355
Plating Tank, World's Largest ... 73
*Polisher and Buffer, Automatic Rotary ... 194
*Polisher, Belt Grinder and ... 401
*Polisher, Belt Grinder and ... 446
*Polisher, Metallographic ... 71
*Polishing and Buffing Lathes ... 28
*Polishing and Buffing Machine, Automatic ... 446
*Polishing and Buffing Machine, Large Production Automatic ... 403
*Polishing and Buffing Machine, New ... 272
Polishing Compounds, Removal of Buffing and ... 190
*Polishing Machine, Selective Speed Buffing and ... 234
*Polishing Machine, Standard Independent Spindle Buffing and ... 271
Polishing Wheel Cement, Flexible ... 447
*Polishing Wheels, Handy Direction Wall Card for Setting Up ... 313
Polymerized Wax Sulphur Bases for Metal Cutting Oils, New ... 312
*Porcelain Enamel Laboratory, Modern ... 149
*Porcelain Enameling, Furnace for ... 450
*Portable Motor Driven Worm Thread Grinder ... 72
*Positive Displacement Pump, Small Capacity ... 72
Precious Metal Plates ... 69
Press, New Filter ... 192
*Pressure Compensator, Automatic ... 271
Preventive for Nickel Pitting ... 272
Preventives, Rust ... 71
Primer, Bituminous Metal ... 316
Primer, Rust Inhibitive ... 316
Primers for Galvanized Iron and Also for Non-Spangled Galvanized Iron ... 405
Priming Vehicle for Aluminum Paint ... 449
Process for Protection of Aluminum, New ... 193
Process, Metal Rebuilding ... 447
Process, New Bright Nickel ... 27
Process, New Chromium Plating ... 356B
Process, New Extrusion ... 235
Process, The Jetal ... 112
Process, The Jetal ... 148
*Process, Zinc Bonderizing ... 353
*Production Automatic Polishing and Buffing Machine, Large ... 403
Proof Cement, Acid ... 356
Protection of Aluminum, A New Process for ... 193
Protective Coating for Zinc ... 273
*Protective Coating, Temporary ... 448
Protective Foundry Coating ... 355
Pulley, Magnetic ... 356
*Pump, Small Capacity Positive Displacement ... 72
Purolator for Sandblasting ... 73
*Pyrometer, Combination ... 148
*Pyrometer, Optical ... 111
*Pyrometer, Recording, Controlling ... 401


## R


*Rack, New Plating ... 194
*Racks, Special Insulated Plating ... 402
*Racks, Use of Korolac as a Protective Coating on Electroplating ... 26
Radio Tube Coating, Metal ... 25
*Readability of Thermometers, Improved ... 405
Rebuilding Process, Metal ... 447
*Recording, Controlling Pyrometer ... 401
Reflector, Alzak ... 356B
Refractories, Improvements in ... 399
Refractories, Mullite ... 148
Refractories, New Plastic ... 400
*Refractory, Castable ... 402
Re-Made Buffs ... 70
*Remote Valve Control ... 147
Removal of Buffing and Polishing Compounds ... 190
Research Institute, Scientific ... 451
Resins for Cellulose Ester Lacquers, New ... 312
*Resistant Specialties for Use in Plants Handling Corrosive Agents, New Corrosion ... 490
Resisting Floors, Acid ... 495
Resisting Vehicle, Heat ... 403
Resistor Type Rocking Electric Furnace ... 70
*Respirator, Hood ... 492
*Respirators, Approved ... 452
Rhodium Comparator ... 271
Rocker, Safety Carboy ... 74
Rocking Electric Furnace, Resistor Type ... 70
Rod, New Cathode ... 71
*Rod Straightener and Shear Machine ... 494
*Roll Necks, Oil-Lubricated Sleeve Bearings for ... 235
*Rotary Polisher and Buffer, Automatic ... 194
Rubber and Bitumen ... 356
*Rubber Latex Pail, Flexible ... 493
*Rule, Apex Slide ... 234
Rust Inhibitive ... 494
Rust Inhibitive Primer ... 316
Rust Preventives ... 71


## S


Safety Carboy Rocker ... 74
*Safety Device, Novel ... 406
*Safety Goggle, New ... 493
*Salt Bath Installation, Automatic Electric ... 447
Salts for Non-Ferrous Metals, Bath ... 495
*Sand Deformation Tester ... 315
Sandblasting, Purolator for ... 73
*Sander, Electric ... 493
*Sander, Improved ... 191
*Sanding and Finishing, New Electric Machine for ... 448
*Sandpaper, Electrocoated ... 192
*Sandslingers, Gyratory Screen Unit for ... 111
*Screen Unit Sandslingers, Gyratory ... 111
Scientific Research Institute ... 451
*Selective Speed Buffing and Polishing Machine ... 234
*Semi-Automatic Plating Machine ... 25
Separator, Centrifugal Air ... 315
"Service" for Motor Maintenance, New "Brush Charting" ... 314
Service, New Testing ... 149
Service, Testing ... 191
*Set for Boric Acid Content in Nickel Solutions, Analytical ... 447
*Shafting, New Flexible ... 355
*Shear Machine, Rod Straightener and ... 494
*Sheet Buffing Machine ... 316
Sheet Metal on Non-Metal Back ... 234
*Show, Wheelabrator Line Exhibited at Foundry ... 192
Sizes, New Low Temperature Brazing Alloy ... 490
*Sleeve Bearings for Roll Necks, Oil-Lubricated ... 235
*Slide Rule, Apex ... 234
*Small Capacity Positive Displacement Pump ... 72
*Small Wheelabrator Tum-Blast ... 232
*Snagging Grinders ... 494
*Solder Baths, Electrified ... 315
*Solder Spray Gun ... 450
Soldering Aluminum, Cast Iron, etc., Flux for ... 451
Soldering Flux ... 270
Soluble Grinding Oil and Paste ... 314
Solution Control, Plating ... 355
Solution, Copper Plate ... 356A
Solution, New Chromium ... 232
Solutions, Bright Nickel and Chromium ... 28
*Solvent Degreasing Machine ... 354
Solvent Emulsion, New ... 356A
*Special Insulated Plating Racks ... 402
Special Metal Finishes ... 356
*Specialties for Use in Plants Handling Corrosive Agents, New Corrosion Resistant ... 490
*Special Vapor-Spray-Vapor Detrex Degreaser ... 492
Spectrum Measuring Microscope ... 71
*Special Lathe, Variable ... 147
*Spindle Buffing & Polishing Machine, Standard Independent ... 271
*Spray Equipment for Use with Synthetic Materials ... 406
*Spray Gun, Fast Production ... 191
*Spray Gun Fluid Strainer ... 233
*Spray Gun, New ... 490
*Spray Gun, Solder ... 450
*Spray Machine, Metal ... 73
*Spray Nozzles for Descaling Service, Improved ... 448
*Spray-Vapor Detrex Degreaser, Special Vapor- ... 492
*Standard Independent Spindle Buffing & Polishing Machine ... 271
*Station Type Descaling Machine, Full Automatic ... 489
Steel, Acme Colored Superstrip Strip ... 449
Steel, Blue on ... 312
Steel Cleaning, New Basic Chemical for ... 403
Steel from Corrosion, New Enamels to Protect Iron and ... 355
Steel with Aluminum, Coating ... 24
*Straightener and Shear Machine, Rod ... 494
*Strainer, Spray Gun Fluid ... 233
String Brush, The Lea ... 404
Strip Steel, Acme Colored Superstrip ... 449
*Styles, Compensated Belt in Two New ... 489
Sulphur Bases for Metal Cutting Oils, New Polymerized Wax ... 312
Sulphur, Improved Liquid ... 447
Synthetic Enamel Resists Heat and Alcohol ... 233
Synthetic Finish Unmarred by Drawing Operation ... 148
*Synthetic Materials, Spray Equipment for Use with ... 406


## T


*Table, American Wheelabrator Multi-Rotary ... 110
*Tank Linings, Koroseal ... 493
Tank, World's Largest Plating ... 73
*Tanks, Dewatering ... 452
Tanks, Korolac Dipping ... 191
Temperature Brazing Alloy Sizes, New Low ... 490
*Temperature Control ... 72
*Temperature Electric Furnace, New High ... 400
*Temporary Protective Coating ... 448
*Tester, Sand Deformation ... 315
Testing Buffing Compounds ... 445
Testing Service, New ... 149
Testing Service ... 191
*Thermometer, Capstan Head ... 491
*Thermometers, Improved Readability of ... 405
*Thread Grinder, Portable Motor Driven Worm ... 72
Tin Plating Machine ... 451
Trigamine ... 236
*Tum-Blast, Small Wheelabrator ... 232
*Tumbling and Burnishing Barrels ... 233
*Two New Styles, Compensated Belt in ... 489
*Type Joint, New ... 451


## U


*Use of Korolac as a Protective Coating on Electroplating Racks ... 26


## V


*Valve Body and Wedge Facing Machine, Gate ... 356A
*Valve Control, Remote ... 147
*Vapor-Spray-Vapor Detrex Degreaser, Special ... 492
*Variable Speed Lathe ... 147
Vehicle for Aluminum Paint, Priming ... 449
Vehicle, Heat Resisting ... 403
*Vulcanizer, World's Largest ... 400


## W


*Wall Card for Setting Up Polishing Wheels, Handy Direction ... 313
*Water Alloy, Copper Hot ... 401
Wax Sulphur Bases for Metal Cutting Oils, New Polymerized ... 312
*Wedge Facing Machine, Gate Valve Body and ... 356A
Welding, "Invisible Ray" ... 355
Wheel Cement, Flexible Polishing ... 447
*Wheel Dressing Machine ... 270
*Wheelabrator Line Exhibited at Foundry Show ... 192
*Wheelabrator Multi-Rotary Table, American ... 110
*Wheelabrator Tum-Blast, Small ... 232
*Wheel, New Finishing ... 490
*Wheels, Handy Direction Wall Card for Setting Up Polishing ... 313
White Coatings, Black or ... 356B
Wite-Brass Plate, Alrose ... 488
World's Largest Plating Tank ... 73
*World's Largest Vulcanizer ... 400
*Worm Thread Grinder, Portable Motor Driven ... 72


## Z


Zinc, Barrel Plating Bright ... 446
*Zinc Bonderizing Process ... 353
Zinc Deposit, Bright ... 233
Zinc Plating, Bright ... 28
Zinc Deposit, Bright ... 494
Zinc, Protective Coating for ... 273


# EQUIPMENT—FIRMS

## A


Acme Mfg. Co., Detroit, Mich., *Automatic Polishing and Buffing Machine ... 446
Acme Mfg. Co., Detroit, Mich., *New Polishing & Buffing Machine ... 272
Acme Steel Co., Chicago, Ill., Acme Colored Superstrip Strip Steel ... 449
Ajax Electric Co., Inc., Philadelphia, Pa., *Ajax-Hultgren Heat Treating Furnace ... 311
Ajax Electric Co. Inc., Philadelphia, Pa., *Automatic Electric Salt Bath Installation ... 447
Albachrome Corp., Long Island City, N. Y., New Chromium Plating Process ... 356B
Alox Corp., Niagara Falls, N. Y., *Corrosion Inhibitors ... 450
Alrose Chemical Company, 80 Clifford Street, Providence, R. I., The Jetal Process ... 112
Alrose Chemical Company, 80 Clifford St., Providence, R. I., The Jetal Process ... 148
Alrose Chemical Co., Providence, R. I., Alrose Wite-Brass Plate ... 488
Alumaweld Co. of America, Chicago, Ill., Flux for Soldering Aluminum, Cast Iron, etc. ... 451
Aluminum Co. of America, Pittsburgh, Pa., Alzak Reflector ... 356B
Aluminum Smelting & Refg. Company, Cleveland, Ohio, New Aluminum Alloy ... 192
American Anode, Inc., Akron, Ohio, *Temporary Protective Coating ... 448
American Foundry Equipment Company, 408 Byrkit Street, Mishawaka, Ind., *American Wheelabrator Multi-Rotary Table ... 110
American Foundry Equipment Company, 408 Byrkit Street, Mishawaka, Ind., *Dustube Collector ... 70
American Foundry Equipment Company, Mishawaka, Ind., *Featherweight Foundry Flask ... 24
American Foundry Equipment Co., Mishawaka, Ind., *Rod Straightener and Shear Machine ... 494

American Foundry Equipment Company, Mishawaka, Ind., *Small Wheelabrator Tum-Blast ... 232
American Foundry Equipment Company, 408 Byrkit Street, Mishawaka, Ind., *Wheelabrator Line Exhibited at Foundry Show ... 192
American Nickeloid Co., Peru, Ill., Sheet Metal on Non-Metal Back ... 234
American Optical Co., Southbridge, Mass., *New Safety Goggle ... 493
American Radiator Co., N. Y. C., *Copper Hot Water Alloy ... 401
American Solder and Flux Company, Wayne Ave. and Berkley Street, Philadelphia, Pa., Metallic Coating ... 192
Apothecaries Hall Co., Waterbury, Conn., The Nucast 99% plus Nickel Anode ... 404
Asphalt Products Co. Inc., Syracuse, N. Y., Special Metal Finishes ... 356
Automatic Machine Co., Bridgeport, Conn., *Gate Valve Body and Wedge Facing Machine ... 356A

## B

Bakelite Corporation, 247 Park Ave., New York, *New Alloy for Making Molds for Plastics ... 69
Bakelite Corp., New York, New Resins for Cellulose Ester Lacquers ... 312
Baker & Co., Inc., Newark, N. J., Rhodium Comparator ... 271
Bassick Co., Bridgeport, Conn., *New Corrosion Resistant Specialties for Use in Plants Handling Corrosive Agents ... 490
Bausch and Lomb, Rochester, N. Y., Spectrum Measuring Microscope ... 71
Beardsley & Piper Company, 2541 N. Keeler Ave., Chicago, Ill., *Gyratory Screen Unit for Sandslingers ... 111
Behr-Manning Corporation, Troy, N. Y., *Electrocoated Sandpaper ... 192
Belke Manufacturing Company, 947 N. Cicero Avenue, Chicago, Ill., *Mechanical Plating Barrels ... 25
Belke Manufacturing Company, Chicago, Ill., *Polishing and Buffing Lathes ... 28
Binks Mfg. Company, 3114 Carroll Avenue, Chicago, Ill., *Fast Production Spray Gun ... 191
Bohn Aluminum & Brass Corp., Detroit, Mich., *Bohn Autothermic Aluminum Piston ... 491
Botfield Refractories Company, Swanson & Clymer Streets, Philadelphia, Pa., A Plastic Insulation ... 70
Bradley & Vrooman Company, 2629 So. Dearborn Street, Chicago, Ill., Synthetic Finish Unmarred by Drawing Operation ... 148
Bullard Co., Bridgeport, Conn., *Full Automatic Station Type Descaling Machine ... 489
Burgess Laboratories Inc., C. F., Freeport, Ill., *Novel Safety Device ... 406
Burns Mfg. Corp., E. Reed, Brooklyn, N. Y., Testing Buffing Compounds ... 445

## C

Champion Spark Plug Co., Detroit, Mich., New Plastic Refractories ... 400
Chemical Publishing Company, 175 5th Avenue, New York, Laboratory Mixer ... 74
Chicago Vitreous Enamel Product Company, 1407 S. 55th Court, Cicero, Ill., *Modern Porcelain Enamel Laboratory ... 149
Circo Products Co., Cleveland, Ohio, Tin Plating Machine ... 451
Cleff, J. W., Dusseldorf, Germany, Heat Resisting Lacquer for Aluminum Ware ... 271
Copper Products Inc., 4503 Euclid Ave., Cleveland, Ohio, Chromizing ... 233
Continental Industrial Engineers, Inc., Chicago, Ill., *Automatic Electric Salt Bath Installation ... 447
Crown Rheostat & Supply Co., Chicago, Ill., *New Chromium Plating Anode ... 489
Curran Corp., Somerville, Mass., New Solvent Emulsion ... 356A
Curran Corp., Malden, Mass., *The Hydro-Degreaser ... 451

## D

Daniels Plating Machine Company, Newark, N. J., *New Plating Machine ... 190
Dockson Co., C. H., Detroit, Mich., *Magnesium Alloy Goggles ... 491
Detroit Electric Furnace Co., Detroit, Mich., *New High Temperature Electric Furnace ... 400
Detroit Electric Furnace Co., Detroit, Mich., New Plastic Refractories ... 400
Detroit Electric Furnace Company, 825 W. Elizabeth Street, Detroit, Mich., Resistor Type Rocking Electric Furnace ... 70
Detroit Rex Products Co., Detroit, Mich., *Convevorized, Three-Dip Detrex Degreaser ... 449
Detroit Rex Products Co., Detroit, Mich., Solvent Degreasing Machine ... 354
Detroit Rex Products Co., Detroit, Mich., *Special Vapor-Spray-Vapor Detrex Degreaser ... 492
DeVilbiss Co., Toledo, Ohio, *Hood Respirator ... 492
DeVilbiss Co., Toledo, Ohio, *Spray Equipment for Use with Synthetic Materials ... 406
DeVilbiss Company, Toledo, Ohio, *Spray Gun Fluid Strainer ... 233
Dewey and Almy Chemical Co., Cambridge B., Mass., *Flexible Rubber Latex Pail ... 493
Dietert Co., Harry W. Detroit, Mich., *Sand Deformation Tester ... 315
Dings Magnetic Separator Co., Milwaukee, Wisc., Magnetic Pulley ... 356
Divine Bros. Co., Utica, N. Y., *Automatic Glue Heater ... 313
Divine Bros. Co., Utica, N. Y., *Sheet Buffing Machine ... 316
Divine Bros Co., Utica, N. Y., *Wheel Dressing Machine ... 270
Dodge Div. Chrysler Corp., Detroit, Mich., *Large Degreasing Installation ... 314
du Pont de Nemours & Co., E. I., Wilmington, Del., Primers for Galvanized Iron and Also for Non-Spangled Galvanized Iron ... 405
Dumore Co., Racine, Wisc., *New Lathe Grinder ... 400
Duriron Company, Dayton, Ohio, *Duriron Heat Exchanger ... 193

## E

Elastic Compound Paint Co., Philadelphia, Pa., Bituminous Metal Primer ... 316

## F

Fink, Dr. Colin F., Columbia University, N. Y., Coating Steel with Aluminum ... 24
Flood Co., Cleveland, Ohio, Priming Vehicle for Aluminum Paint ... 449
Foundry Services, Inc., New York City, Protective Foundry Coating ... 355
Foxboro Co., Foxboro, Mass., *Automatic Pressure Compensator ... 271
Foxboro Company, Foxboro, Mass., *Remote Valve Control ... 147

## G

General Abrasive Co., Niagara Falls, N. Y., *Handy Direction Wall Card for Setting Up Polishing Wheels ... 313
General Plate Company, Attleboro, Mass., Precious Metal Plates ... 69
Gillord Sales Corporation, 420 Lexington Avenue, New York, *Metal Spray Machine, ... 73
Gilson Slide Rule Co., Stuart, Fla., *Apex Slide Rule ... 234
Glyco Products Co., Inc., 148 Lafayette St., N. Y., Trigamine ... 236
Goodrich Co., B. F., Akron, Ohio, *Koroseal Tank Linings ... 493
Goodrich Company, B. F., Akron, Ohio, *Use of Korolac as a Protective Coating on Electroplating Racks ... 26
Goodrich Co., B. F., Akron, Ohio, *World's Largest Vulcanizer ... 400
Gorman & Lees, Inc., New York, Acid Resisting Floor ... 495
Grapho Products Inc., Indianapolis, Ind., Copper Plate Solution ... 356A
Grapho Products Inc., Indianapolis, Ind., Joint Breaker ... 356A
Grasselli Chemical Co., Cleveland, Ohio, Bright Zinc Deposit ... 233
Grasselli Chemical Co., Cleveland, Ohio, Plating Solution Control ... 355
Grasselli Chemicals Dept. E. I. du Pont de Nemours & Co., Wilmington, Del. Bright Zinc Deposit ... 494
Gross Engineering Corporation, 2163 W. 105th Street, Cleveland, Ohio, World's Largest Plating Tank ... 73

## H

Hackett Brass Foundry, Detroit, Mich., New Copper Alloy ... 401
Hagan Corp., Pittsburgh, Pa., Centrifugal Air Separator ... 315
Hague and Co. Inc., Alfred, Brooklyn, N. Y., Rubber and Bitumen ... 356
Hammond Machinery Builders, Inc Kalamazoo, Mich., *Automatic Rotary Polisher and Buffer ... 194
Hammond Machinery Builders, Kalamazoo, Mich., *Variable Speed Lathe ... 147
Hanau Engineering Co., Buffalo, N. Y., *Dentist's Electroforming Machine ... 406
Handy & Harman, New York, New Low Temperature Brazing Alloy Sizes ... 490
Hanson Van Winkle-Munning Company, Matawan, N. J., Bright Zinc Plating ... 28
Hanson Van Winkle-Munning Company, Matawan, N. J., *Metallographic Polisher ... 71
Hanson-Van Winkle-Munning Co., Matawan, N. J., New Line of Buffing Compositions ... 488
H-B Instrument Co., Inc., Philadelphia, Pa., *Capstan Head Thermometer ... 491
Hellige, Inc., L. I. City, N. Y., Photo-Chromometer ... 272
Herrington & Randall, Inc., Detroit, Mich., Insulated Oven Panel ... 316
Hilo Varnish Corp., Brooklyn, N. Y., Heat Resisting Vehicle ... 403
Hines Mfg. Co., Cleveland, Ohio, *New Type Joint ... 451
Hisey-Wolf Machine Company, Cincinnati, Ohio, *Portable Motor Driven Worm Thread Grinder ... 72
Hisey-Wolf Machine Co., Cincinnati, Ohio, *Snagging Grinders ... 494
Holden Co., A. F., New Haven, Conn., Bath Salts for Non-Ferrous Metals ... 495
Homer & Staley, Chicago, Ill., Markal Holder ... 313
Homestead Valve Mfg. Company, Corapolis, Pa., *Small Capacity Positive Displacement Pump ... 72
Houghton & Co., E. F., Philadelphia, Pa., Soluble Grinding Oil and Paste ... 314
Hurst and Co., Inc., Adolphe, New York *Electric Furnaces ... 488
Hurst & Co., Inc., Adolphe, New York, New Flux ... 494
Hartzell Mfg. Co., Inc., Dayton, Ohio, *New Chromium Plating Anode ... 489

## I

Independent Pneumatic Tool Co., Chicago, Ill., *Electric Sander ... 493
Independent Pneumatic Tool Co., Chicago, Ill., *New Bench Grinder ... 356
Industrial Gas Div., Consolidated Gas Co., N. Y., *Bench Gas Furnaces ... 449
International Nickel Co. Inc., N. Y., "Free" Machining Monel Metal ... 399

## J

Jackson-Wheeler Metals Service, Inc., Brooklyn, N. Y., Bearing Alloy ... 272

## K

Kelly Plating Company, Rack Div., 10316 Madison Avenue, Cleveland, Ohio, *New Plating Rack ... 194
Kindt-Collins Co., Cleveland, Ohio, *Aluminum Melting Furnace ... 356
Kocour Co., Chicago, Ill., *Analytical Set for Boric Acid Content in Nickel Solutions ... 447
Kux-Lohner Mchc. Co., Chicago, Ill., *Automatic Die Casting Machine ... 314

## L

Lea Mfg. Co., Waterbury, Conn., The Lea String Brush ... 404
Leiman Bros. Inc., Newark, N. J., *Dust Collector ... 402
L'Hommedieu & Sons Co., Chas. F., Chicago, Ill., *Midget Plating Barrel ... 270
L'Hommedieu and Sons, Chas. F., 4521 Ogden Ave., Chicago, Ill., *Tumbling and Burnishing Barrels ... 233
Loewenberg, F., New York City, Heat Resisting Lacquer for Aluminum Ware ... 271
Longoria, Dr. Anton, Yoder Co., Cleveland, Ohio, "Invisible Ray" Welding ... 355

## M

Maas & Waldstein Co., Newark, N. J., Enamel Finish for Die Castings ... 311
Maas and Waldstein Co., Newark, N. J., New Enamels to Protect Iron and Steel from Corrosion ... 355
Maas & Waldstein Co., Newark, N. J., Paper Lacquer ... 493
MacDermid Inc., Waterbury, Conn., Metal Cleaner ... 312
Madison-Kipp Corp., Madison, Wisc., *Large Automatic Die Casting Machine ... 356A
Mallory and Company Inc., P. R., Indianapolis, Ind., Copper Base Alloy ... 72
Manhattan Rubber Mfg. Div. of Passaic, N. J., *New Finishing Wheel ... 490
Manhattan Rubber Mfg. Division, Raybestos-Manhattan, Inc., Passaic, N. J., *Compensated Belt in Two New Styles ... 489
Mann Instrument Corp., Cambridge, Mass., Coatings for Metals ... 315
Mann Instrument Corp., Cambridge, Mass., Soldering Flux ... 270
Masury and Son, John W., Brooklyn, N. Y., Rust Inhibitive Primer ... 316
Metalkote, Inc., 103 Park Avenue, New York, New Metal Coating ... 194
Metallicoat Syndicate, L. I. City, N. Y., *Solder Spray Gun ... 450
Metallurgical Products Co., Philadelphia, Pa., Electric Hand Magnet ... 316
Metalwash Machinery Co., Newark, N. J., *Midget Metal Cleaning Machine ... 313
Midwest Buff Mfg. Co., Cleveland, Ohio, *Mirror Buff ... 489
Miller Company, I. C., 538 Lake Michigan Dr. N. W., Grand Rapids, Mich., Buffing Compositions ... 191

Miller Company, J. C., Grand Rapids, Mich., Chromium Plating Anodes ..... 192
Miller Company, J. C., Grand Rapids, Mich., Korolac Dipping Tanks ..... 191
Miller Company, J. C., Grand Rapids, Mich., New Filter Press ..... 192
Morgan Construction Co., Worcester, Mass., *Oil-Lubricated Sleeve Bearings for Roll Necks ..... 235
Mossberg Pressed Steel Corporation, Attleboro, Mass., Safety Carboy Rocker ..... 74
Motor Improvements, Inc., 365 Frelinghuysen Avenue, Newark, N. J., Purolator for Sandblasting ..... 73
Mullite Refractories Company, Shelton, Ct., Mullite Refractories ..... 148

## N

N. J. Zinc Co., New York City, Protective Coating for Zinc ..... 273
National Separator Co., Worcester, Mass., *Oil Extractor ..... 404
Nelson and Son, J., 830 N. Wells Street, Chicago, Ill., New Cathode Rod ..... 71
Nickel and Chromium Products Company, 250 Park Avenue, New York, Bright Nickel and Chromium Solutions ..... 28
North Bergen Varnish Corp., North Bergen, N. J., Black or White Coatings ..... 356B

## O

Ohio Carbon Co., Lakewood, Ohio, New "Brush Charting Service" for Motor Maintenance ..... 314
Oliver Machinery Co., Grand Rapids, Mich., *15" Disc Grinder ..... 402
Oliver Machinery Co., Grand Rapids, Mich., *Belt Grinder and Polisher ..... 401
Oliver Machinery Co., Grand Rapids, Mich., *Belt Grinder and Polisher ..... 446

## P

Packer Machine Co., Meriden, Conn., *Large Production Automatic Polishing and Buffing Machine ..... 403
Palo-Myers, Inc., New York City, Dept. M.I., Acid-Alkalimeter ..... 272
Palo-Myers, Inc., N. Y., New Electrolytic Apparatus ..... 317
Parker Rust-Proof Co., Detroit, Mich., *Zinc Bonderizing Process ..... 353
Pennsylvania Salt Mfg. Co., Philadelphia, Pa., New Basic Chemical for Steel Cleaning ..... 403
Penola, Inc., 30 Rockefeller Plaza, New York, Rust Preventives ..... 71
Philadelphia Drying Machinery Co., Philadelphia, Pa., *More Flexible Furnace ..... 446
Phillips Can Co., Cambridge, Md., *Electrified Solder Baths ..... 315
Plating Products Co., Newark, N. J., Preventive for Nickel Pitting ..... 272
Proctor and Bond Chemical Co., Clearwater, Fla., Household Cleaner ..... 492
Pulmosan Safety Equipment Corp, Brooklyn, N. Y., *Acid Handling Equipment ..... 354
Pulmosan Safety Equipment Corp., Brooklyn, N. Y., *Approved Respirators ..... 452
Pyrene Mfg. Company, 560 Belmont Avenue, Newark, N. J., A New Process for Protection of Aluminum ..... 193
Pyrene Mfg. Co., Newark, N. J., Metal Rebuilding Process ..... 447
Pyrometer Instrument Company, 109 Lafayette St., New York, *Combination Pyrometer .. 148
Pyrometer Instrument Company, 109 Lafayette Street, New York, *Optical Pyrometer 111

## Q

Quaker Chemical Products Corp., Conshohocken, Pa., New Polymerized Wax Sulphur Bases for Metal Cutting Oils ..... 312
Quaker Chemical Products Corporation, Conshohocken, Pa., Removal of Buffing and Polishing Compounds ..... 190
Quigley Co., N. Y. C., Improvements in Refractory ..... 402
Quigley Co., N. Y. C., Improvements in Refractories ..... 399

## R

R & H Chemicals Dept., duPont Co., Wilmington, Dela., Barrel Plating Bright Zinc 446
Ransom Grinding Machine Co., Oshkosh, Wis., *New Grinding Machine ..... 445
Reed-Prentice Corp., Worcester, Mass., Brass Die Casting Machine ..... 316
Roxalin Flexible Lacquer Co., Elizabeth, N. J. Enamel Stands Chrome Plating and Buffing ..... 355
Roxalin Flexible Lacquer Co., Elizabeth, N. J., Synthetic Enamel Resists Heat and Alcohol ..... 233

## S

Sauereisen Cements Co., Sharpsburg, Pa., Acid Proof Cement ..... 356
Schneible Co., Claude B., Chicago, Ill., *Dewatering Tanks ..... 452
Schneible Company, Claude B., 4755 N. Crawford Avenue, Chicago, Ill., *Multi-Wash Dust Collectors ..... 73
Scientific Research Institute, Detroit, Mich., Scientific Research Institute ..... 451
Siefen Co., J. J., Detroit, Mich., Flexible Polishing Wheel Cement ..... 447
Siefen Company, J. J., 1936 W. Lafayette Blvd., Detroit, Mich., Re-Made Buffs ..... 70
South Florida Test Service, Box 387, Miami, Fla., New Testing Service ..... 149
South Florida Test Service, Box 387, Miami, Fla., Testing Service ..... 191
Sparks Processes, Inc., Norwalk, Conn., New Extrusion Process ..... 235
Special Chemicals Corp., N. Y. C., *Special Insulated Plating Racks ..... 402
Standard Chromium Corporation, 521-5th Ave., N. Y., New Chromium Solution .... 232
Standard Electric Tool Co., Evans & 8th Sts., Cincinnati, Ohio, *Selective Speed Buffing and Polishing Machine ..... 234
Standard Electrical Tool Co., Cincinnati, Ohio, *Standard Independent Spindle Buffing & Polishing Machine ..... 271
Stanley Chemical Company, East Berlin, Conn., Metal Radio Tube Coating ..... 25
Stanley Chemical Company, East Berlin, Conn., Metallic Lacquers ..... 111
Sterling Products Company, Curtis Bldg., Detroit, Mich., *Improved Sander ..... 191
Sterling Products Co., Detroit, Mich., *New Electric Machine for Sanding and Finishing 448
Stoeger, Inc., A. F., Dept. M.I., N. Y. City, Blue on Steel ..... 312
Stow Manufacturing Co. Inc., Binghamton, N. Y., *New Flexible Shafting ..... 355
Sulphur Products Co., Greensburg, Pa., Improved Liquid Sulphur ..... 447
Superior Flake Graphite Company, 33 S. Clark Street, Chicago, Ill., *Foundry Supply House Uses Novel Sales Stimulation .. 148
Surface Combustion Corp., N. Y., *Furnace for Porcelain Enameling ..... 450

## T

Tabor Manufacturing Company, 6225 Tacony Street, Philadelphia, Pa., *Abrasive Cut-Off Machine ..... 111
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y., *Recording, Controlling Pyrometer ..... 401
Taylor Instrument Co., Rochester, N. Y., *Improved Readability of Thermometers .. 405
Titanite Alloys Corporation, Cleveland, Ohio, New Aluminum Alloy ..... 192

## U

Udylite Company, 1651 E. Grand Blvd., Detroit, Mich., *Semi-Automatic Plating Machine ..... 25
U. S. Stoneware Co., Akron, Ohio, Etching Machine ..... 492

## V

Varnish Products Co., Cleveland, Ohio, Rust Inhibitive ..... 494
Vonnegut Moulder Corporation, 1803 Madison Ave., Indianapolis, Ind., Grinders and Buffers ..... 71

## W

Walker Co., H. V., Elizabeth, N. J., Modern Crystal Lacquer ..... 495
Weisberg and Greenwald, Inc., 71 W. 45th Street, New York, New Bright Nickel Process ..... 27
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa., New Brazing Alloy ..... 404
Wilbin Instrument Corporation, 40 E. 34th Street, New York, *Temperature Control 72
Worthington Pump & Machinery Corp., Harrison, N. J., *Improved Spray Nozzles for Descaling Service ..... 448

With this new, patented, quick setting acid proof cement, it is said to be possible to carry on the work of bricklaying continuously as it is not necessary to delay the construction while the cement dries, as is customary with the slower drying silicate of soda type cements.

This new type of quick setting cement is said to be resistant to all acids (except hydrofluoric), oil, fire, water and solvents.

## Large Automatic Die Casting Machine

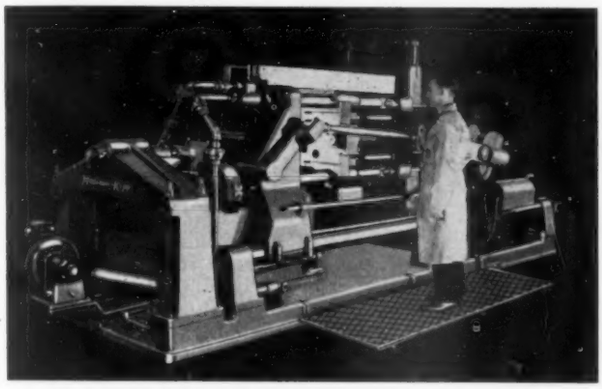
A new large automatic die casting machine has been developed by the Madison-Kipp Corporation, Madison, Wis., called the Number 8 Automatic Die Casting Machine. Sizes of dies, 22½" by 28½"; weight, 30,000 pounds; length, 204"; width, 72"; height, 82". The machine will handle alloys of zinc, aluminum, lead or tin.

The effective capacity for the standard direct air pressure gooseneck is 25 pounds in zinc alloy. Larger than standard goosenecks may be applied. Plunger type goosenecks may also be applied as extras. The metal pot capacity is 1,200 pounds in zinc alloy.

The standard operating speeds are five shots per minute, 3.33 shots per minute, 2½ shots per minute and 1.66 shots per minute. Other speeds may be had by simply changing the motor drive gears.

The machine is driven by a 7½ H.P. multi-speed motor, first through a silent chain drive, the ratio of which is 4.86 to 1; then through worm and worm wheel with a ratio of 74 to 1. The reciprocating action which opens and closes the dies and which automatically provides the proper dwell period for shooting the casting is accomplished through the patented dwell crank cam units which are also standard equipment on other and smaller models of Madison-Kipp automatic die casting machines.

The Number 8 is said to be the largest automatic die casting machine ever built.



**Madison-Kipp No. 8 Automatic Die Casting Machine**

## New Solvent Emulsion

"Gunk"—a new type of solvent emulsion—has been announced by The Curran Corporation, manufacturing chemists, Somerville, Mass.

To remove heavy mineral oils and greases, metal parts are immersed in the cold solvent emulsion. The emulsion comprises low cost distillates of petroleum which are said to quickly penetrate and dissolve the heavy grease and oil accretions. The parts are then removed from the bath and the conditioned grease, which has been emulsified and rendered water soluble, is now thoroughly removed by sluicing off with water. The removed dissolved oils and greases form a stable oil-water emulsion of exceptionally fine particle size and are thus rinsed away, it is stated, eliminating all possible fire hazard that exists with normal accumulations of grease.

The process requires no expensive steam, electric or gas heat for operation.

Gunk solvent emulsions are particularly recommended for removing waxy and oily materials from aluminum, magnesium, brass, and other soft metals, without attacking, etching, or causing loss of weight of the metal. It is claimed by the makers to be unusually safe for use in degreasing all soft metals.

## Joint Breaker

This product developed by Grapho Products, Inc., 2232 Alvord Street, Indianapolis, Indiana, is said to break the most obstinate and corroded joints almost instantly. Pen-A-Trate is a fluid which filters quickly into the threads of joints to be broken. Upon coming in contact with the corrosion Pen-A-Trate, it is claimed, forms a gas which dissolves the rust into a fine powder and permits the joints to be broken easily.

It is for use on joints, bolts, studs, etc., where corrosion has made removal impossible without breaking. If applied thoroughly Pen-A-Trate will loosen these unyielding joints in two or three minutes. Only a tap with a hammer and the joint can easily be removed. It is also recommended for a spring spray when mixed 5% with crank case drainings.

Pen-A-Trate is said to be non-injurious to metal, also non-explosive, and will burn only under intense heat. Pen-A-Trate has no lubrication value and must not be used as an additive for lubrication purposes.

## Copper Plate Solution

This product was developed originally by Grapho Products, Inc., 2232 Alvord Street, Indianapolis, Indiana, to lower the cost of plating where selective hardening is necessary. Kwik-Cote is a chemical compound which deposits a copper plating on the part to be treated by dipping or painting with a small stiff brush. Hair-line separation of hardness can be secured with positive results.

It is claimed that with Kwik-Cote any portion of the part to be hardened can be treated; preparation for hardening takes but a few minutes as the solution dries almost at once and can be placed in the carburizing pots immediately. A scleroscope hardness variation from 80 to 30 is secured. Threads treated with Kwik-Cote may be kept dead soft and in perfect condition while the remainder of the piece is hardened. Only the parts to be kept soft are treated.

It is recommended for use between cams, back of gears, threads, in bores where stock is left for reaming after heat-treating, on springs and any section to be kept soft. It is stated that the solution may also be used as a base for nickel or chrome plating. The work is thoroughly cleaned, dipped in the solution, the surplus liquid washed off and is ready for plating.

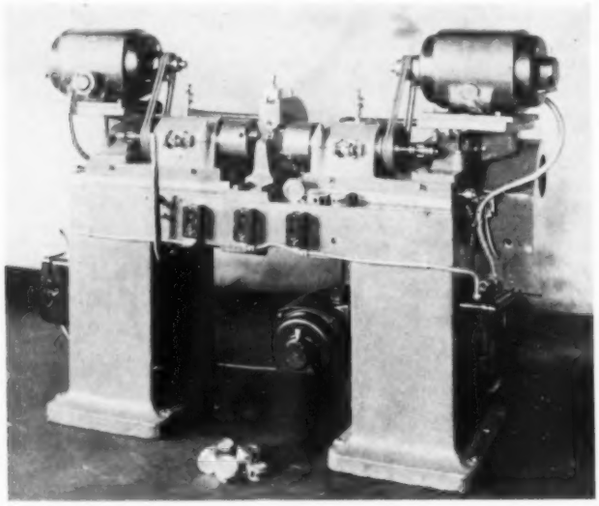
## Gate Valve Body and Wedge Facing Machine

An automatic machine for facing seats on standard brass gate valves and wedges up to 2" size built by the Automatic Machine Company, Bridgeport, Conn.

Both seats finished simultaneously with a roughing and finishing cut. The tool heads and spindles are generous in size and run on ball bearings at high speed made suitable for the use of carboloy tools. All the automatic movements are controlled by suitable camming and the cycle of machine is from 6 seconds on the smaller sizes and up to 12 seconds for the larger sizes made possible by suitable change gearing. By changing work holding fixtures both body and wedge can be finished on the same machine.

Three motors are required; one for each facing spindle and one for driving

the cam shaft controlling the automatic movements to and from the work and facing across the work, roughing and finishing cuts and automatically stop for removing and replacing the work.



Automatic Facing Machine for Gate Valves

## Black or White Coatings

A number of special coatings have been produced by the North Bergen Varnish Corp., 989-1005 39th St., North Bergen, N. J., for use on stampings, drawn metal products such as double shell caps, tobacco tins, etc. The outstanding features claimed for the black coating are its density, brilliance and hardness. It is said to eliminate the usual difficulties experienced by metal decorators with black coating. The tinplate is coated with "Berco" sizing varnish and baked at 300° F. for 17 minutes. Then the Berco black coating is applied and the sheet baked at 300° F. for 17 minutes. The tinplate can then be fabricated, stamped, dipped, deep drawn, etc.

The white heat coating is said to withstand repeated bakes for a period equivalent to two hours at 267° F., without showing the slightest sign of discoloration, and then fabrication without a fracture.

## New Chromium Plating Process

A new chromium plating process has been developed by the Albachrome Corp., 40-35 21st St., Long Island City, N. Y. This solution called "Albachrome," is said to be non-infringing and different in principle from existing methods. It is claimed that no control of any acid radical or addition agent is involved and that nothing has to be added to the bath but chromic acid. The process, it is stated, uses an unstable compound as an addition agent, and the chemical action ensuing does the work. The solution is said to last a long time, probably to a point where accumulated impurities make it desirable to overhaul the bath; said overhaul taking only about an hour or two. The baths call for analysis at regular intervals only for chromic acid and impurities.

The deposit is said to be bright, whitish, pliant and closely adherent with very high throwing power obtainable when required and to operate within the usual range of current densities.

## Alzak Reflector

The Alzak reflector, with reflection efficiencies which run as high as 85 per cent, in its two years of commercial service is said to have demonstrated its practicability for many types of lighting purposes.

The Alzak reflector is provided with a hard, glass-like protective coating, which makes it particularly useful for exterior applications where atmospheric conditions tend to dull the finish of ordinary reflectors. Indoors, where a bare surface would not depreciate materially, this coating is still of great use, for it serves to protect the bright metal surface from any incidental damage.

The hard, transparent, glassy coating is aluminum oxide. Variations in the coating are sometimes employed when unusual conditions of exposure must be conquered. There are two types of surface on Alzak reflectors, specular and diffuse. The specular surface is bright and mirror-like, while the diffuse surface has a frosty, crystalline appearance. The former has great directional control, the latter is more adapted to the spreading of light in as great an area as possible.

In order to produce the exact lighting effect desired, it is sometimes necessary to diffuse the light to a limited extent and at the same time retain considerable directional control. This can be done with Alzak reflectors, for in them one may obtain a variety of surfaces, ranging all the way from specular to matte.

The elevated temperature normally occurring when lights are constantly operated before a reflector do not injure the reflectivity of Alzak reflectors. Another advantage claimed for the new aluminum reflector is that it can be made to serve as the housing for a lighting unit. Lighting units are commonly built by placing a reflector inside an outside housing; this is not necessary with the new reflector. The single shell construction is an aid to the dissipation of heat, for the thermal conductivity of aluminum helps to spread the heat over the entire unit, so that no part of it attains an excessive temperature.

Should a reflector be dented by a blow, the protective coating crazes in the deformed area. This, however, does not cause the coating to chip off. Protection of the outside of the reflector is also given by the hard oxide coating, and no further protection is necessary. By means of suitable chemical or mechanical treatment it is possible to finish the outer surfaces of Alzak reflectors in a number of decorative ways. Various indirect fixtures now on the market indicate the possibilities.

Full information can be obtained from the Aluminum Company of America, Pittsburgh, Pa.

# New Catalogs

**Coated Abrasive Papers and Cloths,** for metal working, wood working and leather working; a catalog and price list. Abrasive Products, Inc. South Braintree, Mass.

**SpecOrak Plating Racks;** to save metal and corrosion; recommended especially for precious metals, such as rhodium, gold, silver, etc. Special Chemicals Corp., 30 Irving Pl., New York City.

**Common Sense Ventilation for Industrial and Commercial Buildings.** ("Not a Technical Treatise"). Bulletin V-100-B. The Swarthout Co., 18511 Euclid Ave., Cleveland, Ohio.

**Ajax Alloys;** for fluxing, deoxidizing and hardening. Ajax Metal Co., Philadelphia, Pa.

# BUSINESS WANTS

## FOR SALE—EQUIPMENT, ETC.

**Display Advertisements, One Column Wide, $3 per inch, Each Insertion**

### FOR SALE

1—2500/1250 Ampere, 6/12 Volts, EAGER ELECTRIC CO. Motor Generator Set, condition like new, complete with full controlling equipment.
2—1500/750 Ampere 6/12 Volt, HANSON-VAN WINKLE-MUNNING CO. Motor Generator Sets, (INTERPOLE DESIGN)—like new and compelte with Panel Boards.
2—1500/750 Ampere 6/12 Volt, EAGER ELECTRIC CO. Motor Generator Sets, excellent condition throughout, complete with controlling equipment.
1—1500/750 Ampere, 6/12 Volt, HANSON VAN WINKLE CO. Motor Generator Set, excellent shape, complete with panel board.
1—1000/500 Ampere, 6/12 Volt, EAGER ELECTRIC CO. Motor Generator Set, excellent condition, complete with Panel Board arrangement.
1—1000 Ampere 6 Volt, MUNNING-OPTIMUS. Motor Generator Set, excellent shape and complete with full controlling equipment.
1—750/375 Ampere, 6/12 Volt, HANSON-VAN WINKLE-MUNNING CO. (INTERPOLE-DESIGN). Motor Generator Set, like new and complete throughout.
4—800/400 Ampere 6/12 Volt, HANSON VAN WINKLE CO. Belt Driven Generators. Excellent shape.
5—500/250 Ampere 6/12 Volt, MUNNING-OPTIMUS CO., Motor Generator Sets. Perfect condition.
7—U. S. ELECTRICAL TOOL CO. 5 HP. Ball Bearing (Motor-in-Head) Polishing Lathes, complete with magnetic controls, 220-3-60-1800 R.P.M.—1¼" arbor. Excellent Condition.
2—BAIRD MACHINE CO.—DOUBLE NO. 2 SIZE BALL BURNISHING BARRELS.
2—BAIRD MACHINE CO.—DOUBLE NO. 1 SIZE BALL BURNISHING BARRELS.
5—ABBOTT BALL CO.—BALL BURNISHING BARRELS. (various sizes.)

**MANY OTHER SIZES IN STOCK**

BAIRD & ABBOTT—Burnishing and Tumbling Barrels, Polishing Lathes, Rheostats, Ammeters, Blowers, Tanks, Polishing Wheels and many other items for the Plating and Polishing Department.

**WRITE FOR DETAILS**

**M. E. BAKER COMPANY**
79-81 Haverhill St. Boston, Mass.

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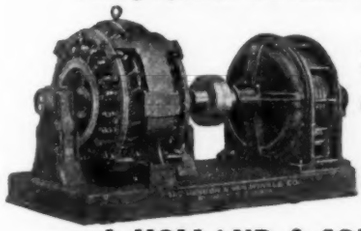
**REBUILT AND GUARANTEED**
## POLISHING AND PLATING EQUIPMENT
*Plating Dynamos and Motor Generator Sets*



**All Sizes Carried in Stock**

Tumbling and Plating Barrels and most anything for the Plating Shop.

**Largest Stock of Rebuilt Polishing and Plating Supplies in America**

Let us have your requirements. Entire plants or parts thereof bought for cash. Send us list with prices.

**J. HOLLAND & SONS, INC.**
489 BROADWAY Tel. STagg 2-5128, EV. 7-8989 BKLYN., N. Y.

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## USED BUFFS

**64-6S—1⅛" arbor—20 ply**

**Full disc—Loose—or Sewed**

Thousands of every size.

**8"—7c each** **9"—8c each**

**10"—10c each**

**MICHIGAN BUFF CO., Inc.**
4054 Beaufait Avenue Detroit, Mich.

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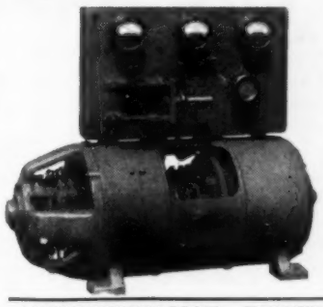
## PLATING GENERATOR BARGAINS



Specializing in the complete rebuilding of plating generators, Moreco rebuilt units are often better than the original machine when new. You can depend upon any Moreco rebuilt plater to operate to your satisfaction under load, with good commutation, no sparking and minimum brush wear. Investigate the values listed below. Priced to Sell. Fully Guaranteed.

**PERFORMANCE TESTED—GUARANTEED**

**PLATING GENERATORS**

| | AMP. | VOLTS | MAKE |
|---|---|---|---|
| | 50 | 6 | Stevens |
| | 100 | 6 | Hanson Van Winkle |
| | 100 | 7½ | Rochester |
| | 100 | 7½ | Hobart with 110/220 volt, 60 cycle motor |
| | 12/60 | 7½/15 | Eager |
| | 125 | 7½ | Rochester |
| | 150 | 6 | Connecticut |
| (3) | 200 | 7½ | Hobart with 220/400 volt, 3 phase 60 cycle direct connected motor, same as illustration |
| | 200 | 7½ | Acme with 220 volt, 3 phase, 60 cycle direct connected motor |
| | 250 | 7½ | Rochester |
| | 300/150 | 7½/15 | Hobart with 220 volt, 3 phase, 60 cycle direct connected motor, same as illustration |
| | 400/200 | 6½ | Hobart with 220 volt, 3 phase, 60 cycle direct connected motor, same as illustration |
| (2) | 400/200 | 6½ | Hanson Van Winkle |
| | 600/300 | 6½ | Giant |
| (2) | 1000/500 | 6½ | Hanson Van Winkle |
| | 1000/500 | 6½ | Bennett O'Connell |

**THE MOTOR REPAIR & MFG. CO.**
1555 Hamilton Ave. Cleveland, Ohio

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## SPECIALISTS in reconditioned PLATING AND POLISHING EQUIPMENT

**All used equipment reconditioned by factory-trained workmen and guaranteed to be in perfect operating condition.**

**A few especially attractive items:**

**SPECIAL**

1—1000 Ampere, 6 Volt HANSON-VAN WINKLE Motor Generator Set, complete with control panel board. Excellent condition.
1—750 Ampere, 6 Volt HANSON-VAN WINKLE Motor Generator Set. Separately excited with or without control panel board equipment. Ideal for small chrome plating installation.
1—500/250 Ampere, 6/12 Volt OPTIMUS (A. P. Munning Co.) Motor Generator Set. Like new.
1—3 HP. Motor-in-head Ball Bearing Polishing Lathe. Equivalent to new.
2—Hill-Curtis No. 5 Double Spindle Ball Bearing Lathes, with 3 HP. individual motors mounted in base.

**MANY OTHER ITEMS CARRIED IN STOCK**

**PLATING PRODUCTS COMPANY**
352 Mulberry Street Newark, N. J.
**We Carry a Complete Stock of Plating and Polishing Supplies.**

# BUSINESS WANTS

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**FOR SALE**
**Used Polishing Lathes**
**Babbitted Bearings**
All sizes by well known manufacturers—at very low prices.
To make room for our new
**TIMKEN ROLLER BEARING POLISHING LATHES**
Lewis Roe Manufacturing Company
1042-1050 De Kalb Avenue
Brooklyn, N. Y.
New York Office and Salesroom
86 Walker St.
New York, N. Y.
CAnal 6-2580

**We have on hand and offer subject to prior sale:**

3—1500 Ampere Motor Generator Sets Rebuilt like new.
1—1000 Ampere Belt Driven Generator—Rebuilt.
A number of generators of smaller capacity; both motor and belt driven.
Also a quantity of Double Independent Spindle Ball Bearing Polishing Lathes.
All the above is in first class condition. Prices on application.

**BEAM-KNODEL, INC.**
195 Lafayette St., N. Y. City

## Wanted—Equipment and Supplies.

**SAVE SCRAP** "THE SCRAP NICKEL MARKET SINCE 1909"

We are paying special prices for any quantity of scrap.

**NICKEL ANODES • • CADMIUM ANODES • • NICKEL STRIPPINGS**

Discarded plating room scrap of all kinds.
Write—Phone—Wire
**HIGHEST PRICES—IMMEDIATE RETURNS**

METALLURGICAL PRODUCTS CO.
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**SPECIALTY WANTED**

The writer is in excellent position to market a specialty, product or process to the metal finishing industry. Will buy or act as agent.

Address Sulphur Products Co., Inc., Greensburg, Pa.

**FOR RESULTS**
**ADVERTISE IN**
**METAL INDUSTRY**

## SITUATIONS OPEN

**FOREMAN—Polishing Compositions**

Man with thorough knowledge and experience in the manufacture of polishing compositions. State age and experience. Furnish references and any other details necessary. Sales outlet to be to the metal manufacturing and electroplating trades.

Address 27 N. c/o Metal Industry

**FOREMAN—Cleaning Compounds**

High calibre man with thorough knowledge of the manufacture of metal cleaning compounds. State age, furnish references and details as to experience. Man to take complete charge of the department. The main sales outlet will be to the electroplating trade.

Address—55 F. c/o Metal Industry

# BUSINESS WANTS

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### FOREMAN PLATER

SITUATION OPEN: Foreman Plater to take charge of a complete barrel plating department. Must have had experience in handling men. Must be capable of controlling all plating solutions. Nickel-copper, brass, cadmium, Parkerizing chromium and other finishes in very large quantities. Give all details in first letter—age—experience.

Parkerizing, care of Metal Industry

### SALESMEN

A fast growing manufacturer of electroplating and cleaning chemicals has an opening for two (2) high grade, progressive sales representatives. Excellent opportunity. Give full particulars in writing. Address Post Office Box 75, Station D, New York City.

### GRADUATE ELECTRO CHEMIST

SITUATION OPEN—Graduate Electro Chemist, five to ten years experience, for development and operation of new plating process. Give age, education, experience, salary desired.

Plating Process, care of Metal Industry.

## SITUATIONS WANTED

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### ELECTROCHEMIST
### With Own Processes

Specialist in electrodeposition, cleaning and treatment of metals—thorough practical experience of more than ten years—intimately familiar with the bright nickel plating developments of Harshaw, Schloetter (Pyrene), Hanson-Van Winkle-Munning (Weisberg), McGean, with bright tin, zinc, cadmium—have own developments in this field also for treatment of chrome alloys etc.—seeks responsible position with reliable corporation : development work and supervision or as service engineer Finest credentials.

Specialist, care of Metal Industry.

### FOREMAN PLATER

SITUATION WANTED—By a foreman plater who desires a permanent connection with a progressive firm who is interested in obtaining only the highest grade results. Has been accustomed to handling volume production, can take complete charge and be responsible for production and costs. Experience includes chromium, cadmium, gold, silver, nickel, brass, bronze, zinc and copper plating upon ferrous and non-ferrous metals, including die casting alloys. The applicant is capable of producing decorative chromium plating of unusual brightness which excludes the use of patented solutions and does not infringe upon patented processes. This eliminates license fees and auditing of books. Am thoroughly familiar with all solutions in still as well as barrel and mechanical moving cathode tanks, and control solutions by chemical analysis. My experience also includes oxidizing, lacquering, barrel tumbling and ball burnishing and use of all modern methods to produce satisfactory results. Am not interested in job shops, but would appreciate a permanent position with a reliable manufacturing firm. Moderate salary, location unimportant, high-grade references submitted.

Address Electro, care of Metal Industry.

### SUPERINTENDENT OR FOREMAN

SITUATION WANTED—Plating, polishing and buffing, automatic polishing, buffing and ball burnishing. 20 years experience, eight of this in charge of large job shops. Can do any kind of plating including bright nickel and hard chrome. Have worked on indicator shells, grilles, hub caps, cooking utensils, electrical supplies, steel stampings, bicycle parts, vacuum sweepers, die castings, etc.

Die Castings, care of Metal Industry.

### CHEMIST

SITUATION WANTED—Chemist, Analyst with long and varied experience desires position. Will take charge of laboratory or serve as assistant if opportunities for advancement are offered.

Analyst, care of Metal Industry.

### SITUATION WANTED

SITUATION WANTED—Young man, technical graduate with 6 years plating experience on full automatic barrel and still plating. Can control solutions by analysis. Desires position as chemist or plater. Can go anywhere.

Address Chemist, care of Metal Industry.

### PLATING ENGINEER

SITUATION WANTED—Graduate Chemical Engineer, age 38. I am thoroughly experienced and have knowledge of all phases of electro-plating. Guarantee to produce quality work economically and meet commercial standards. Salary required $3,600 per year. I will go anywhere within the United States.

Plating Engineer, care of Metal Industry

### METALLURGIST-CHEMIST

SITUATION WANTED—University graduate, twenty years experience ferrous and non-ferrous metals. Laboratory control materials and processes, heat treatment of metals, electroplating and metal finishing problems. Varied experience in machinery, automotive and hardware fields. Desires responsible position with reliable firm in East. Excellent references.

Address F. J. C., care of Metal Industry.

### EXPERT PLATER

SITUATION WANTED by expert plater with 20 years of practical and theoretical experience with all now known plating solutions and finishes on all kinds of metal. Executive ability. High grade references.

Experience, care of Metal Industry.

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**To Locate Advertisements of Firms Listed Refer to Alphabetical Index Page 50***

**ABRASIVES (Also see Emery)**
J. C. Miller Company, Grand Rapids, Mich.
Artificial
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Emery
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Stevens, Inc., Frederic, B., Detroit, Mich.

**ACID PIPE**
Belke Mfg. Co., Chicago, Ill.
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
U. S. Rubber Products, Inc., New York.

**ACID PROOF PIPE**
Resistance, Hard Rubber
Belke Mfg. Co., Chicago, Ill.
General Ceramics Co., New York
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
U. S. Rubber Products, Inc., New York.
U. S. Stoneware Co., New York

**ACID RESISTING FLOORS**
Gorman & Lees, Inc., New York

**ACIDS**
Boracic
Harshaw Chemical Co., The, Cleveland, Ohio.
McGean Chemical Co., The, Cleveland, Ohio.
Chromic
Chas. Cooper & Co., New York.
Grasselli Chemical Co., The, Cleveland, Ohio.
Harshaw Chemical Co., The, Cleveland, Dhio.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
McGean Chemical Co., The, Cleveland, Ohio.
Mutual Chemical Co. of America, New York.
Hydrofluoric
General Chemical Co., Philadelphia, Pa.
Harshaw Chemical Co., The, Cleveland, Ohio.
Oil of Vitriol (Sulphuric)
Zapon Co., The, New York, N. Y.

**AEROPLANE DOPE**
Egyptian Lacquer Mfg. Co., New York.
Zapon Co., The, New York, N. Y.

**AGITATORS FOR PLATING SOLUTIONS**
Belke Mfg. Co., Chicago, Ill.
Mechanical
J. C. Miller Company, Grand Rapids, Mich.
Belke Mfg. Co., Chicago, Ill.
Hanson-Van Winkle-Munning Co., Matawan, N. J.

**AIR FILTERS**
Kirk & Blum Mfg. Co., Cincinnati, Ohio.

**ALLOYS (See also Kind Wanted)**
Non-Ferrous
Seymour Mfg. Co., Seymour, Conn.
Brass, Bronze, Nickel, Silver
Seymour Mfg. Co., Seymour, Conn.

**ALUMINUM (Sheets, etc.)**
Sheet
Arthur Seligman & Co., Inc., New York.
Strahs Aluminum Co., New York.

**ALUMINUM CLEANER**
International Chemical Co., Phila., Pa.
Magnus Chemical Co., Garwood, N. J.
Magnuson Products Corp., Brooklyn, N. Y.

**ALUMINUM INGOT**
Arthur Seligman & Co., Inc., New York.

**AMMETERS** (See also Electrical Apparatus and Equipment.)
Hanson-Van Winkle-Munning Co., Matawan, N. J.

**AMYL ACETATE**
Maas & Waldstein Co., Newark, N. J.
Zapon Co., The, New York, N. Y.

**ANODES**
All Metals
Belke Mfg. Co., Chicago, Ill.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Harshaw Chemical Co., The, Cleveland, Ohio.
McGean Chemical Co., The, Cleveland, Ohio.
J. C. Miller Company, Grand Rapids, Mich.
Brass and Bronze
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Harshaw Chemical Co., The, Cleveland, Ohio.
MacDermid Incorporated, Waterbury, Conn.
McGean Chemical Co., The, Cleveland, Ohio.
Seymour Mfg. Co., Seymour, Conn.
Cadmium
Grasselli Chemical Co., Cleveland, Ohio.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Harshaw Chemical Co., The, Cleveland, Ohio.
McGean Chemical Co., The, Cleveland, Ohio.
Copper
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Harshaw Chemical Co., The, Cleveland, Ohio.
MacDermid Incorporated, Waterbury, Conn.
McGean Chemical Co., The, Cleveland, Ohio.
Seymour Mfg. Co., Seymour, Conn.
Stevens, Inc., Frederic B., Detroit, Mich.
Lead
Harshaw Chemical Co., The, Cleveland, Ohio.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Nickel
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Harshaw Chemical Co., The, Cleveland, Ohio.
MacDermid Incorporated, Waterbury, Conn.
McGean Chemical Co., The, Cleveland, Ohio.
Seymour Mfg. Co., Seymour, Conn.
Stevens, Inc., Frederic B., Detroit, Mich.
Tin
E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.
Harshaw Chemical Co., The, Cleveland, Ohio.
McGean Chemical Co., The, Cleveland, Ohio.
Zinc
du Pont de Nemours & Co., E. I., Inc., The R. & H. Chemicals Dept., Wilmington, Del.
Grasselli Chemical Co., Cleveland, Ohio.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Harshaw Chemical Co., The, Cleveland, Ohio.
International Chemical Co., Philadelphia, Pa.
McGean Chemical Co., The, Cleveland, Ohio.

**AUTOMATIC METAL CLEANING MACHINES**
N. Ransohoff, Inc., Cincinnati, Ohio.

**AUTOMATIC POLISHING MACHINES**
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Hammond Mach. Builders, Inc., Kalamazoo, Mich.

**AUTOMATIC WIRE AND SHEET METAL WORKING MACHINERY**
Baird Machine Co., Bridgeport, Conn.

**BALL BURNISHING EQUIPMENT**
Abbott Ball Co., The, Hartford, Conn.
Baird Machine Co., Bridgeport, Conn.
Belke Mfg. Co., Chicago, Ill.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
N. Ransohoff, Inc., Cincinnati, Ohio.

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Kirk & Blum Mfg. Co., Cincinnati, Ohio.
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**BLOWERS AND BLOW PIPING (See also Fans.)**
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**BLOWERS AND EXHAUSTERS**
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**BLOWER SYSTEMS**
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**BOLTS, MONEL METAL**
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Western Cartridge Co., East Alton, Ill.

**BRASS; SHEET, WIRE, ROD, TUBE (Also see Rods and Bars, Sheets; Strip Metals; Wire, Etc.)**
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Western Cartridge Co., Alton, Ill.
Waterbury Rolling Mills, Waterbury, Conn.

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J. C. Miller Company, Grand Rapids, Mich.
Stevens, Inc., Frederic B., Detroit, Mich.
The Matchless Metal Polish Co., Glen Ridge, N. J.
J. J. Siefen Co., Detroit, Mich.
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Yerges Buff Co., Fremont, Ohio.
Felt
The Bias Buff and Wheel Co., Inc., Jersey City, N. J.
Eastern Felt Co., Winchester, Mass.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Yerges Buff Co., Fremont, Ohio.
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Hanson-Van Winkle-Munning Co., Matawan, N. J.
Sheepskin
Hanson-Van Winkle-Munning Co., Matawan, N. J.

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Michigan Buff Co., Inc., Detroit, Mich.

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J. C. Miller Company, Grand Rapids, Mich.
J. J. Siefen Co., Detroit, Mich.
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Ransohoff, N., Inc., Cincinnati, Ohio.
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McGean Chemical Co., The, Cleveland, Ohio.

**CADMIUM OXIDE**
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Harshaw Chemical Co., The, Cleveland, Ohio.
McGean Chemical Co., The, Cleveland, Ohio.

**CADMIUM PLATING**
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**CHAIN, MONEL METAL**
International Nickel Co., New York.

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Harshaw Chemical Co., The, Cleveland, Ohio.
McGean Chemical Co., The, Cleveland, Ohio.

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Special Chemicals Corp., New York, N. Y.

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McGean Chemical Co., The, Cleveland, Ohio.
J. C. Miller Company, Grand Rapids, Mich.
Mark Weisberg Laboratories, Providence, R. I.

CHLORIDE
Nickel
Harshaw Chemical Co., The, Cleveland, Ohio.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
McGean Chemical Co., The, Cleveland, Ohio.

CHROMIC ACID
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Grasselli Chemical Co., The, Cleveland, Ohio.
Harshaw Chemical Co., The, Cleveland, Ohio.
McGean Chemical Co., The, Cleveland, Ohio.
Mutual Chemical Co. of America, New York, N. Y.

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Standard Chromium Corp., New York.

CHROMIUM PLATING PROCESS
Standard Chromium Corp., New York.
United Chromium, Inc., New York.

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American Hard Rubber Co., New York.
Belke Mfg. Co., Chicago, Ill.
General Ceramics Co., New York.
J. C. Miller Company, Grand Rapids, Mich.
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
U. S. Stoneware Co., New York.

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Chas. F. L'Hommedieu & Sons, Chicago, Ill.
Hanson-Van Winkle-Munning Co., Matawan, N. J.

CHROMIUM PLATING FUMES EXHAUST SYSTEMS
Allington & Curtis Co., Saginaw, Mich.
Kirk & Blum Mfg. Co., Cincinnati, Ohio.

CHROMIUM PLATING POLISH
E. Reed Burns Mfg. Corp., Brooklyn, N. Y.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Harrison & Co., Haverhill, Mass.
Lea Mfg. Co., Waterbury, Conn.
Matchless Metal Polish Co., Glen Ridge, N. J.—Chicago.
J. C. Miller Company, Grand Rapids, Mich.

CHUCKING MACHINES, AUTOMATIC
Baird Machine Co., Bridgeport, Conn.

CLEANERS, METAL
Ford, J. B. Co., Wyandotte, Mich.
Gumm, Frederick, Chemical Co., Union City, N. J.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Harshaw Chemical Co., The, Cleveland, Ohio.
International Chemical Co., Philadelphia, Pa.
Chas. F. L'Hommedieu & Sons, Chicago, Ill.
MacDermid, Inc., Waterbury, Conn.
Magnus Chemical Co., Garwood, N. J.
Magnuson Products Corp., Brooklyn, N. Y.
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Oakite Products, Inc., New York.
Philadelphia Quartz Co., Philadelphia, Pa.
Sulphur Products Co., Greensburg, Pa.
Udylite Process Co., Detroit, Mich.

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U. S. Galvanizing & Plating Equipment Corp., Brooklyn, N. Y.

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Ford, J. B. Co., Wyandotte, Mich.
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Harshaw Chemical Co., The, Cleveland, Ohio.
International Chemical Co., Philadelphia, Pa.
MacDermid, Inc., Waterbury, Conn.
Magnus Chemical Co., Garwood, N. J.
Magnuson Products Corp., Brooklyn, N. Y.
J. C. Miller Company, Grand Rapids, Mich.
Oakite Products, Inc., New York.
Philadelphia Quartz Co., Philadelphia, Pa.
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Kirk & Blum Mfg. Co., Cincinnati, Ohio.

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Kirk & Blum Mfg. Co., Cincinnati, Ohio.

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Belke Mfg. Co., Chicago, Ill.

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The Bias Buff and Wheel Co., Inc., Jersey City, N. J.
Belke Mfg. Co., Chicago, Ill.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Lea Mfg. Co., Waterbury, Conn.
Chas. F. L'Hommedieu & Sons, Co., Chicago, Ill.
Matchless Metal Polish Co., Glen Ridge, N. J.
J. C. Miller Company, Grand Rapids, Mich.
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Magnuson Products Corp. Brooklyn, N. Y.
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CONVEYING SYSTEMS (Pneumatic Light and Heavy Materials.)
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Kirk & Blum Mfg. Co., Cincinnati, Ohio.

CONSULTANTS
Mark Weisberg Laboratories, Providence, R. I.
Special Chemicals Corp., New York, N. Y.

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Sheet, Wire, Rod, Tube
American Brass Co., Waterbury, Conn.

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Cooper, Chas. & Co., New York, N. Y.
du Pont de Nemours & Co., E. I., Inc, The R. & H. Chemicals Dept., Wilmington, Del.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Harshaw Chemical Co., The, Cleveland, Ohio.
McGean Chemical Co., The, Cleveland, Ohio.

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Harshaw Chemical Co., The, Cleveland, Ohio.
McGean Chemical Co., The, Cleveland, Ohio.

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Kirk & Blum Mfg. Co., Cincinnati, Ohio.
Stevens, Inc., Frederic B., Detroit, Mich.
Oil and Gas
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Kirk & Blum Mfg. Co., Cincinnati, Ohio.
Stevens, Inc., Frederic B., Detroit, Mich.

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Strip Metal
Baird Machine Co., Bridgeport, Conn.

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McGean Chemical Co., The, Cleveland, Ohio.

CYANIDE OF SODIUM
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Grasselli Chemical Co., The, Cleveland, Ohio.
Harshaw Chemical Co., The, Cleveland, Ohio.
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U. S. Rubber Co., New York.
Stoneware
General Ceramics Co., New York.
U. S. Stoneware Co., New York.

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U. S. Galvanizing & Plating Equipment Corp., Brooklyn, N. Y.
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Kirk & Blum Mfg. Co., Cincinnati, Ohio.
Cloth Screen
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DUST COLLECTING OUTFIT, POLISHING
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Allington & Curtis Mfg. Co., The, Saginaw, Mich.
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Bogue, Chas. J., Electric Co., New York, N. Y.
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Kirk & Blum Mfg. Co., Cincinnati, Ohio.

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Bogue, Chas. J., Electric Co., New York.

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Udylite Process Co., Detroit, Mich.

ELECTROLYTIC NICKEL FOR ALLOYING
International Nickel Co., New York.

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Hanson-Van Winkle-Munning Co., Matawan, N. J.
Chas. F. L'Hommedieu & Sons, Chicago, Ill.
J. C. Miller Company, Grand Rapids, Mich.
U. S. Galvanizing & Plating Equipment Corp., Brooklyn, N. Y.

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Matchless Metal Polish Co., Glen Ridge, N. J.—Chicago, Ill.
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Stevens, Inc., Frederic B., Detroit, Mich.
The Plating Products Co., Newark, N. J.
U. S. Galvanizing & Plating Equipment Corp., Brooklyn, N. Y.
Mark Weisberg Laboratories, Providence, R. I.

ELECTRO PLATING, JOB & CONTRACT (Also see Polishing and Burnishing; Plating, Barrel Method.)
Chromium Process Co., Shelton, Conn.
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Stevens, Inc., Frederic B., Detroit, Mich.

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Zapon Co., The, Stamford, Conn.
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Zapon, The, Co., Stamford, Conn.
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U. S. Galvanizing & Plating Equipment Corp., Brooklyn, N. Y.
Electro Plating
Hanson-Van Winkle-Munning Co., Matawan, N. J.
U. S. Galvanizing & Plating Equipment Corp., Brooklyn, N. Y.

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Zapon Co., The, Stamford, Conn.

EXHAUST SYSTEMS
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Hanson-Van Winkle-Munning Co., Matawan, N. J.

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Eastern Felt Co., Winchester, Mass.

FELT WHEELS
Eastern Felt Co., Winchester, Mass.

FIG CLEANERS (Also see Cleaning Compounds, Whale Oil Soap.)
Magnus Chemical Co., Garwood, N. J.

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Grasselli Chemical Co., The, Cleveland, Ohio.
Krembs & Co., Chicago, Ill.

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FURNACE CEMENT
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Campbell-Hausfeld Co., Harrison, Ohio.
Fisher Furnace Co., Chicago, Ill.
Monarch Eng. & Manufacturing Co., Baltimore, Md.

FUSE METAL
Platt Bros. & Co., Waterbury, Conn.

GALVANIZING EQUIPMENT AND SUPPLIES (See Kinds Wanted. Also Plating Galvanizing Machines. Automatic.)
Hanson-Van Winkle-Munning Co., Matawan, N. J.
U. S. Galvanizing & Plating Equipment Corp., Brooklyn, N. Y.

GENERATORS (See Dynamos; Motor-Generator Sets.)
Belke Mfg. Co., Chicago, Ill.
Beam-Knodel, Inc., New York.
Bogue Electric Co., Chas. J., Hoboken, N. J.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Chas. F. L'Hommedieu & Sons, Co., Chicago, Ill.
J. C. Miller Company, Grand Rapids, Mich.
The Plating Products Co., Newark, N. J.
Stevens, Inc., Frederic B., Detroit, Mich.

GLUE FOR POLISHING
The Bias Buff and Wheel Co., Inc., Jersey City, N. J.
Hanson-Van Winkle-Munning Co., Matawan, N. J.

GLUE HEATERS AND POTS
Hanson-Van Winkle-Munning Co., Matawan, N. J.

GLOVES (Leather combinations, Work & Cotton)
Bias Buff & Wheel Mfg. Co., Inc., Jersey City.

GOLD SOLUTIONS
Mark Weisberg Laboratories, Providence, R. I.
Special Chemicals Corp., New York.

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Lea Mfg. Co., The, Waterbury, Conn.
The Matchless Metal Polish Co., Glen Ridge, N. J.

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Hanson-Van Winkle-Munning Co., Matawan, N. J.

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International Chemical Co., Philadelphia, Pa.
Oakite Products, Inc., New York.
Magnuson Products Corp., Brooklyn, N. Y.

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Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Stevens, Inc., Frederic B., Detroit, Mich.
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Hanson-Van Winkle-Munning Co., Matawan, N. J.
Portable

HARD RUBBER FITTINGS
Pipe
Belke Mfg. Co., Chicago, Ill.

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Allington & Curtis Mfg. Co., The, Saginaw, Mich.
Kirk & Blum Mfg. Co., Cincinnati, Ohio.

HYDROGEN PEROXIDE
McGean Chemical Co., The, Cleveland, Ohio.

INGOTS
Aluminum
Arthur Seligman & Co., Inc., New York.
Strahs Aluminum Co., New York.

JAPAN REMOVERS
International Chemical Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Magnuson Products Corp., Brooklyn, N. Y.
Oakite Products, Inc., New York.
Stanley Chemical Co., East Berlin, Conn.

JAPANS, ALL KINDS
Stanley Chemical Co., East Berlin, Conn.

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Mark Weisberg Laboratories, Providence, R. I.

KOROLAC COVERING & EQUIPMENT
B. F. Goodrich Co., Akron, Ohio.
J. C. Miller Company, Grand Rapids, Mich.

KOTERAX COVERING & EQUIPMENT
Hanson-Van Winkle-Munning Co., Matawan, N. J

LACQUER ENAMELS (See Enamels.)
Stanley Chemical Co., East Berlin, Conn.
Zapon, The, Co., Stamford, Conn.

LACQUERS
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Agate Lacquer Co., Long Island City, N. Y.
Charles Cooper & Co., New York.
Egyptian Lacquer Mfg. Co., New York.
Maas & Waldstein Co., Newark, N. J.
Stanley Chemical Co., East Berlin, Conn.
Zapon, The, Co., Stamford, Conn.
For Incandescent Lamps
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**To Locate Advertisements of Firms Listed Refer to Alphabetical Index Page 50***



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**To Locate Advertisements of Firms Listed Refer to Alphabetical Index Page 50***

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# « « INDEX TO ADVERTISERS » »


**A**

Abbott Ball Co., The, Hartford, Conn. ..... 26
Acme Mfg. Co., Detroit, Mich. ..... 8
Albachrome Corp., Long Island City, N. Y. .. 29
Allington & Curtis Co., Saginaw, Mich. ..... 18
Alrose Chemical Co., Providence, R. I. .... 25
American Brass Co., Waterbury, Conn. .... 39
American Nickeloid Co., Peru, Ill. ..... 40
American Steel Abrasive Co., The, Galion, Ohio ..... 47
Astle, H. J., Co., Providence, R. I. ..... 26

**B**

Baird Machine Co., The, Bridgeport, Conn. .. 33
Baker, M. E., Co., The, Boston, Mass. ..... 41
Baltimore Brass Co., The, Baltimore, Md. .. 46
Beam-Knodel, Inc., New York ..... 42 & 45
Belke Mfg. Co., Chicago, Ill. ..... 7, 9 & 11
Bias Buff & Wheel Co., Inc., The, Jersey City, N. J. ..... 10
Bogue Elec. Mfg. Co., Hoboken, N. J. ..... 26
Bristol Brass Corp., The, Bristol, Conn. ..... 46
Burns, Reed E., Mfg. Co., Brooklyn, N. Y. .. 26

**C**

Campbell, Hausfeld Co., Harrison, Ohio .... 8
Chromium Process Co., Shelton, Conn. ..... 48
Cleveland Blow Pipe & Mfg. Co., Cleveland, Ohio ..... 20
Conn. Dynamo & Motor Co., Irvington, N. J. 34

**D**

Divine Bros. Inc., Utica, N. Y. ..... 18

**E**

Eastern Felt Co., Winchester, Mass. ..... 18
Egyptian Lacquer Mfg. Co., New York, N. Y. 37

**F**

Fisher Furnace Co., Chicago, Ill. ..... 46
Ford, J. B., & Co., Wyandotte, Mich. ..... 24

**G**

General Ceramics Co. Inc., New York ..... 12
General Chemical Co., Philadelphia, Pa. .... 47
Gorman & Lees, Inc., New York ..... 48
Gumm Chemical Co., Inc., Frederick, Union City, N. J. ..... 10

**H**

Hammond Machinery Builders, Inc., Kalamazoo, Mich. ..... 17
Handy & Harman Co., New York ..... 19
Hanson-Van Winkle-Munning Co., Matawan, N. J. ..... 38
Harshaw Chemical Co., The, Cleveland, O. .. 10
Holland & Sons, Inc., Brooklyn, N. Y. ..... 41

**I**

Industrial Filter & Pump Mfg. Co., Chicago, Ill. ..... 50
International Chemical Co., Phila., Pa. ..... 52
International Nickel Co., New York, N. Y.. 5 & 21

**K**

Kirk & Blum Mfg. Co., Cincinnati, Ohio .... 12
Krembs & Co., Chicago, Ill. ..... 47

**L**

Lea Mfg. Co., The, Waterbury, Conn. ..... 1
Leiman Bros., Inc., New York ..... 34

**M**

MacDermid Inc., Waterbury, Conn. ..... 28
McGean Chemical Co., The, Cleveland, Ohio .. 22
Magnus Chemical Co., Garwood, N. J. ..... 22
Magnuson Products Corp., Brooklyn, N. Y. .. 3
Matchless Metal Polish Co., Chicago, Ill., and Glen Ridge, N. J. ..... 32
Matthiessen & Hegeler Zinc Co., La Salle, Ill. 40
Metallurgical Products Co., Phila., Pa. ..... 42
Miller, J. C. Co., Grand Rapids, Mich. ..... 20
Monarch Eng. & Mfg. Co., Baltimore, Md. .... 48
Motor Repair & Mfg. Co., The, Cleveland, Ohio ..... 41
Mutual Chemical Co. of America, New York, N. Y. ..... 24

**O**

Oakite Products, Inc., New York, N. Y. ... 34

**P**

Philadelphia Quartz Co., Philadelphia, Pa. .. 32
Plating Products Co., Newark, N. J. ..... 41
Platt Bros. & Co., The, Waterbury, Conn. ... 40
Pyrometer Instrument Co., New York, N. Y. 45

**R**

Ransohoff, Inc., N., Cincinnati, O. ..... 8
Rochester Brass Corp., Rochester, N. H. .... 48
Roe Mfg. Co., Lewis, Brooklyn, N. Y. ..... 42
Russell Electric Co., Chicago, Ill. ..... 49

**S**

Schweizer, Chas. K., St. Louis, Mo. ..... 46
Seifen Co., J. J., Detroit, Mich. ..... 30
Seivering, Philip, Inc., New York, N. Y. .... 28
Seligman & Co., Inc., Arthur, New York, N. Y. ..... 40
Special Chemicals Corp., New York ..... 4
Standard Chromium Corp., New York ..... 27
Stanley Chemical Co., East Berlin, Conn. .... 30
Stevens, Inc., Frederic B., Detroit, Mich. .... 35
St. Joseph Lead Co., New York ..... 13
Storts Welding Co. Inc., Meriden, Conn. .... 16
Strahs Aluminum Co., New York ..... 40
Sulphur Products Co., Inc., Greensburg, Pa. .. 46

**U**

United Chromium, Inc., New York ..... 51
Udylite Co., The, Detroit, Mich. ..... 23
U. S. Galvanizing & Plating Equip. Corp., Brooklyn, N. Y. ..... 31
U. S. Rubber Products, Inc., New York .. 14 & 15

**V**

Vulcan Detinning Co., The, Sewaren, N. J. .. 47

**W**

Walker, H. V., Elizabeth, N. J. ..... 32
Waterbury Rolling Mills, Inc., Waterbury, Conn. ..... 40
Western Cartridge Co., East Alton, Ill. ..... 40
Williamsville Buff Mfg. Co., Danielson, Conn. 30

**Y**

Yerges Mfg. Co., The, Fremont, O. ..... 28

**Z**

Zapon Company, The, New York, N. Y., Stamford, Conn. ..... 2

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